GAS JOURNAL, AUGUST 28, 1940

VOL. 231 92nd YEAR No. 4032

EDITORIAL NOTES

A CO-ORDINATION PLAN

THE new scheme of co-operation for the three Chartered Bodies of the chemical industry—the Chemical Society, the Institute of Chemistry, and the Society of Chemical Industry—has now been published. Explanation of the scheme, which we think will be found acceptable to the majority of chemists, was given by Professor Philip in his recent Address as President of the Society of Chemical Industry, and details have subsequently appeared in the Society's *Journal*. The potential value of this co-operative plan would appear to be considerable. The proposed agreement is to be for a period of seven years, to be continued for successive periods of three years thereafter, subject to the right of any one of the constituent bodies to retire therefrom at the end either of the first seven years or of any triennial period. The Chemical Society will keep its annual membership subscription at £3; and as between that Society and the Society of Chemical Industry the scheme provides an attractive possibility of joint membership and choice of publications. To make this possible, it is proposed to increase the annual membership subscription of the Society of Chemical Industry from £2 10s. to £3, and to limit the publications supplied to Fellows of the Chemical Society. Those who belong to both Societies would pay less than at present and would have a wide choice of publications without additional charge. Fellows and Associates of the Institute of Chemistry are asked to become joint members of all three bodies by payment of an annual joint membership subscription of £5 5s. Members of the Chemical Society or the Society of Chemical Industry who are not Fellows or Associates of the Institute of Chemistry will be accepted as joint members of the two societies on payment of a joint membership susbcription of £5. Chemists may, we think, look forward with confidence to wholehearted co-operation between the three constituent bodies which form the Chemical Council.

SAY IT WITH FLOWERS

IN the present grim circumstances prevailing in this country it is not uninteresting to turn to the Gas Industry activities of our friends across the Atlantic who have never been wanting in sales ingenuity and enterprise and who are going ahead handsomely under conditions of peace and with fewer "noises on." We have been reading in the American Gas Association *Monthly* of a recent scheme staged by a gas undertaking in Michigan which for some time has been active in investigating different civic activities carried on in its area of supply—the idea being to assist in some activity that would indicate the undertaking's desire to promote worthwhile civic enterprises and at the same time enable it to become better acquainted with its consumers. Now the florists and citizens of Muskegon—the place in question—had long wanted a flower show. The idea appealed to the gas undertaking, which put up a proposal offering to supply a showroom and furnish suitable prizes to the florists, together with sufficient advertising. It was understood at the outset that neither the undertaking nor the florists would be allowed to sell or attempt to commercialize on the flower show in any way. There was immediate response to the suggestion. Advertising was carried on by the undertaking ten days prior to the show. The undertaking erected all backgrounds. Modern gas appliances were interspersed in a background of flowers and shrubbery; and from the account we have been reading the effect of the showroom when completed was unbelievable; there was no indication that the flower show had been built up inside a gas undertaking's sales and home service premises.

The undertaking had thought it possible to attract 10,000 people to the show for three days. In the event an attendance of over 13,000 people proved the venture a huge success. Hundreds of comments, not only verbal but written, were received by the gas undertaking, indicating what a pleasure to the community the organization of the show had been. It cost the undertaking about £320. Was it worth while from a purely business point of view? The undertaking concerned has no doubt about the answer to this question. But the greater asset was the building-up of a volume of goodwill—and goodwill does count in the Gas Industry, as indeed, in any other industry. This is a pretty story. On a more severe note, however, gas undertakings in Great Britain are building up goodwill and undoubtedly helping the national effort in times the reverse of easy by helping housewives how to make the very best use of foodstuffs, how to prepare meals, nourishing meals, at little cost and with an absolute minimum of labour, and in spreading an atmosphere of friendliness which will not be readily dissipated when the war ends. That there is no letting-up in this effort by the Gas Industry is a good augury for the future, when gas undertakings here, like the undertaking in Michigan, may indulge in sponsoring flower shows.

SULPHUR DIOXIDE RECOVERY

THE problem of the economic recovery of sulphur dioxide from waste gases is dealt with in the current issue of *Industrial and Engineering Chemistry*, by Messrs. Johnstone and Singh, of Illinois University. They described a new process, worked out on the pilot plant stage, for the regeneration of sulphite-bisulphite solutions used for absorbing the sulphur dioxide. It is based on the precipitation of zinc sulphide, followed by decomposition of the dried solid in a flash calciner to give pure sulphur dioxide and zinc oxide, the latter being recycled. The pilot plant has been in operation for two years, and thorough consideration has been given to the capital costs and operating costs of the process. The Authors conclude that the costs compare favourably with processes used in English installations for gases from low-sulphur coals and are much less than the cost of the English processes when applied to high-sulphur coals. Criticism will be levelled against the large amount of equipment required; but the Authors maintain that the cost exceeds by only 30% that required by other systems now in use on dilute waste gases and producing only large quantities of waste material.

The possibility of commercial development of the recovery process depends on several economic factors, as is readily admitted in the Paper. The conclusions reached are that the production of relatively small quantities of liquid sulphur dioxide, such that there would be no disturbance of market conditions, the process should show a profit. Furthermore, according to the best available estimates of the production costs, by-product sulphur dioxide could actually undersell sulphur dioxide produced from crude sulphur at the present price of brimstone. On the other hand, production of large tonnages of sulphur dioxide will inevitably reduce the selling price to near the value of the sulphur equivalent. At this point, transportation and storage costs become serious, and reduction to elemental sulphur would have to be considered for at least a part of the product.

The total annual production of liquid sulphur dioxide in the United States at present is about 12,000 tons. Most of it is used for refrigeration, as a selective solvent, as an antichlor, as a bleaching agent, and, to a limited extent, as a chemical reagent. The present uses themselves, state the Authors, probably could not absorb a much greater quantity even at lower prices. The possibility of developing new uses for cheap sulphur dioxide exists, however, and this must be considered.

Cheap sulphur dioxide can displace sulphur in the paper industry. Then there are the new sulphur dioxide—olefin resins containing nearly 50% sulphur dioxide produced by reaction of liquid sulphur dioxide with certain waste refinery gases. These resins are thermoplastic, mouldable, acidproof, and stable up to 300° C., and have high dielectric strength. Because of the nature of their ingredients they are among the cheapest of the purely synthetic fabricating materials. The Authors envisage other possible new uses of sulphur dioxide in certain metallurgical processes and as a raw material for heavy chemicals.

The general conclusion reached regarding the development of the zinc oxide process and other processes for recovering sulphur dioxide from waste gases is that large-scale development will come in only as new uses are found for the product so that the disposal problem is automatically solved; and the broad programme of the investigation of the sulphur problem includes research along these lines.

Nazis Dislike Ramsgate Gas-Works

Last Saturday morning Ramsgate received some considerable attention from Nazi air raiders. It is estimated that 250 bombs were dropped by the raiders, of which there are believed to have been 300. Rows of seaside villas were wiped out and many people were rendered homeless. At the Corporation's Gas-Works there was an outbreak of fire. After bombing the houses, the raiders returned to machine-gun the firemen dealing with this outbreak. All very pretty work!

Looking Ahead

When it is presented for the judgment of the Higher Courts, a good deal of attention will undoubtedly be devoted to a case in which a plaintiff has lately been awarded damages and costs. Of a surety, he who braves the block-out must walk warily if he would avoid, at the least, some personal injury. Even with the exercise of the utmost care, one cannot altogether rule out the possibility of coming "up against it," with more or less disastrous results. In this particular instance, the "it" which the plaintiff came "up against" was a sandbin, which it was argued was not visible to him as an obstruction while he was walking along the pavement, with the result that he sustained a fractured rib. How many persons must have collided with some such obstacle during last winter's black-out, and how many are doomed to like collisions during the forthcoming months of darkness? The figures comprising a correct answer would probably be of staggering proportions. The wayfarer should therefore be urged to "look ahead," while he, in his turn, might plead for such "guidance" as may be practicable. This, of course, is altogether apart from the question of legal liability, upon which it would be wrong to express any opinion while the matter remains *sub judice*. Contributory negligence was urged on behalf of the defendant corporation, but it was pointed out by the Judge that they could have taken steps to minimize danger by applying some paint or whitewash to the sandbin. Because, he said, the corporation were absolved from their duty of lighting the streets, this did not free them from any other duty towards persons walking along the streets imposed upon them by the common law. It is greatly to be feared that, at best, the pedestrian must find his way hard, during the hours of darkness, without the inestimable blessing of an efficient street lighting installation. Good public lighting will be appreciated more than ever after the war.

Short Cuts

According to the Parliamentary Correspondent of *The Times*, the Prime Minister has recently invited his colleagues in the Government and all heads of departments in the Civil Service to "join in an effort to save everybody's time by condensing official papers and avoiding official jargon." Mr. Churchill added: "To do our work, we all have to read a mass of papers. Nearly all of them are too long. This wastes time, while energy has to be spent in looking for the essential points." This statement deserves to be placed on permanent record, in the hope that it may lead to a sustained betterment in the practice of compiling—not only official—reports and papers. Thus might benefit spread right down from Parliament until it reached even the sorely tried staffs of newspapers. Admittedly, it is not always so easy to write "in brief" as it is "at length," but it must be preferable that one compiler should be put to extra trouble, than that innumerable readers should have their time and energy unnecessarily drawn upon in the way indicated by the Prime Minister. But even the compiler will be amply repaid for any extra trouble to which he may be put; for it is certain that, as Mr. Churchill points out, "the discipline of setting out the real points concisely will prove an aid to clearer thinking."

Personal

Mr. G. C. REID has been appointed to a vacancy on the Board of the Catrine Gas Company.

* * *

Mr. M. H. TAYLOR, son of the Borough Treasurer, has been appointed Technical Assistant to the Clitheroe Gas Department.

* * *

At its September meeting the Manchester City Council will be asked to confirm the appointment of Mr. ROWLAND WALKER, at present Manager of the Partington Works, as Chief Engineer to the Gas Department. Mr. Walker will succeed Mr. A. L. Holton, who is retiring at the end of the year.

* * *

To fill the vacancy on the Board occasioned by the retirement of Mr. H. N. Lipscomb, Mr. T. C. BATTERSBY, the General Manager and Chief Engineer, has been elected a Director of the Watford and St. Albans Gas Company. Mr. Battersby joined the St. Albans Company 18 years ago, and in 1928 was promoted to Assistant Works Manager; later he became Works Manager and Engineer. In 1937 he became Chief Engineer, and in May of last year was appointed General Manager and Chief Engineer. Mr. Battersby, still, of course, holds this position as well as his Directorship.

* * *

Mr. ALEXANDER TRAN, Assistant Engineer and Manager of the Reading Gas Company, has been appointed to the position of Engineer and Manager of the Oxford and District Gas Company.

Mr. Tran received his Technical training at the Royal Technical College, Glasgow, and preparatory to his apprenticeship as a Gas Engineer, he served for two years with a Glasgow firm of Measurers and Surveyors. He joined the staff of the Glasgow Corporation Gas Department in 1919, and received five years training in the engineering and structural drawing offices and three years' training in the workshops and laboratories. In 1927 he was appointed Assistant Engineer and Manager of the Helensburgh Corporation Gas Department, and has since held similar appointments with the Coatbridge Gas Company from 1931 to 1934, the Bath Gas Company from 1934 to 1938, and the Reading Gas Company since 1938.

Mr. Tran was awarded the diploma of The Institution of Gas Engineers in 1932, and was President of the Scottish Junior Gas Association (Western District) in 1933, and President of the Western Junior Gas Association in 1938.

* * *

The Kernot Memorial Medal for 1939 has been awarded to Mr. C. F. BROADHEAD, Engineer of the Metropolitan Gas Company, Melbourne. The Medal was established in 1926 to commemorate the late William Charles Kernot, the first Professor of Engineering at the Melbourne University, and is awarded from time to time for distinguished engineering achievement in Australia. In 1938 the University Council decided that the occasion of the presentation of the Medal should be made a ceremonial one, and that the recipient should be asked to deliver a public lecture at the University on an engineering subject chosen by himself. Mr. Broadhead has been requested by the Vice-Chancellor to do so.

The Kernot Memorial Medal has been awarded to Mr. Broadhead for his research work over the past 20 years in connexion with the complete gasification of coal, which has now reached full-scale operations. It will be recalled that Mr. Broadhead was awarded the 1937 Gold Medal of The Institution of Gas Engineers, for his Paper, "The Consolidation of Gas," which he read at the Institution Meeting of that year. It was the first occasion on which it had been awarded for a Paper from Australia.

Obituary

Thomas Fox

Mr. THOMAS FOX died at his home in Liverpool, on Aug. 12, aged 65, after a very short illness. Born in Oldham, he served an apprenticeship with the Gas Meter Company, and was subsequently associated with many other gas meter firms, not only in England but in Holland, before joining the staff of Messrs. J. H. Robinson & Co. (Liverpool), Ltd., 25 years ago.

An Appreciation

By S. Robinson

As I believe that I have been associated with the late Mr. Fox in his business life longer than any other, it falls to me to make some small tribute to him as a man, and to his exceptional ability. I believe that with his creative brain, and his flair for ingenious mechanisms, he had few peers in the meter industry. He will always be remembered for his pioneer work on the H.C. meter, the two-coin prepayment mechanism, and meter lubrication. Like all inventors, he was a stranger to satisfaction, for him there were always new avenues to explore and investigate. As a man he was ever generous, his reward was in his work, and his friends will remember that no trouble was too great for him. He devoted his life to give of his best, and he knew only excellence. The Industry has lost an able man and the writer a very loyal friend.

The Institution of Chemical Engineers has decided to lend £2,000 to the Government free of interest for the duration of the war.

A Reduction in the Price of Gas by 10d. per 1,000 cu.ft. was agreed to by the Millport Town Council last week. It was stated that with this decrease in price revenue would be reduced by £930, leaving, on a steady consumption, £250-£300 to meet rising costs of coal, materials, and wages.

With so many Rumours flying about, it is as well to have proof of statements or happenings. At least, so thought a Watford consumer, observes the Gas Company's *Wartime Review*, for, not content just to tell the Company that her gas bill was high because there was a leak in the pipe, she sent the pipe along to prove it!

Several Gas Showrooms in the Lancashire area have posted notices in their windows and inside announcing that after night air raid warnings their premises will not open till 10 a.m., and in some cases 10.30 a.m., to give assistants—especially those on A.R.P. duty during the night—an opportunity to rest.

The Chairman of the Long Melford Parish Council stated at a recent meeting that the Sudbury Gas and Coke Company were within their legal rights in demanding one-third of the contract price for Melford's street lighting, though no lamps were in use. The contract was for £135; a 1d. rate yielded £40. It was agreed that £25 should be offered as full discharge of the Council's liability in this matter.

In their Showrooms in Osborne Street, Grimsby, the Great Grimsby Gas Company have been staging an effective window display of "Wings Over Europe—The R.A.F. Goes To It." A scale model Spitfire floats over a large map of Europe while all round are photographs of wrecked German machines brought down by our pilots, with photographs of our Hurricanes and Spitfires in action and photographs of the pilots.

The Gas Sales Figures of the Watford and St. Albans Gas Company for the first half of 1940 show an increase of 9.92%, made up of increases in both domestic and industrial consumption. The Company are, indeed, reaping the benefit of gas apparatus installed in pre-war days; industry is going full steam ahead; houses are all occupied; and also of great importance is the fact that, with the partial cancellation of holidays, people are staying at home and using gas.

Mention was Made at the monthly meeting of Nottingham City Council of the lack of co-ordination between the Gas and Electricity Committees. One councillor pointed out that under existing arrangements the gas employee calls at a house to empty the prepayment meter and is followed next day by the electricity employee who attends to the electricity meter. He said this was a foolish as well as a wasteful method. Separate men are also sent round by each Department to read the meters for the quarterly accounts.

Wartime Cookery Demonstrations by the Hawick Gas Company were opened by Mr. J. E. S. Nisbet, Chairman of the Roxburghshire Education Committee. Addressing a numerous gathering, Mr. Nisbet said he was appalled by tests he had carried out that morning in the schools in the town. He had set out to ascertain how many of the children had had porridge and milk for breakfast. In one school, out of 309 children questioned, only 99 had had porridge; in another only 29 out of 248. He urged a return to milk and porridge for breakfast, and advised mothers to take more advantage of the Government's new scheme for cheap or free milk. This must be used to supplement and not to substitute present purchases. He had heard of milk thus obtained being sold, but he was confident no such disgraceful thing would happen in Hawick.

Forthcoming Engagements

Sept.

4.—I.G.E.—Corbet Woodall Scholarship Committee, 2 p.m.

6.—North British Association.—Date provisionally fixed for Annual Meeting at Edinburgh. Papers by Mr. A. B. Munro (Edinburgh) and Mr. J. M. Dow (Kirkcaldy).

10.—I.G.E.—Finance Committee, 2 p.m.; Membership Committee, 2.30 p.m.

17.—I.G.E.—Gas Education Executive Committee, 11 a.m.; Gas Education Committee, 2 p.m.

19.—Gas Research Board.—Refractory Materials Joint Committee, 2.30 p.m.

26.—Gas Research Board.—Joint Committee on Complete Gasification under Pressure, 2.30 p.m.

27.—Gas Research Board.—Joint Research Committee, 2 p.m.

27.—I.G.E.—Liquor Effluents and Ammonia Committee, 12.15 p.m.

Oct.

1.—Gas Research Board.—Finance Committee, 12 noon; Council, 2.30 p.m.

7.—I.G.E.—Finance Committee, 1.45 p.m.; Membership Committee, 2.15 p.m.; General Purposes Committee, 3 p.m.; Benevolent Fund Committee of Management, 4.30 p.m.

8.—I.G.E.—Council, 10 a.m.

9.—I.G.E.—Board of Examiners, 2 p.m.

15.—I.G.E.—Gas Education Executive Committee, 2 p.m.

Crude Tar Prices

[Specially Contributed]

AN editorial comment in the "JOURNAL" of Aug. 14 referred to the difficulty of quoting the usual crude tar prices weekly, owing to the export of pitch to the Continent now being cut off. This raises the following point. With little or no demand for pitch, stocks of which are accumulating, with a consequent slump in value, an interesting development arises which might be pursued, and which should find a temporary market for all the pitch producers, to counterbalance the loss of exports.

On June 20, the Ministry of Home Security (Smoke Production Division) sent out instructions to all Smoke Abatement Officers and selected local authorities to prevail on all industrial works, both large and small, in their area to emit as much black smoke as possible, pointing out that though this appeared to be a retrograde step, it must now be regarded in the national interest to carry these instructions out. But here is the rub! It was pointed out in the circular letter "That it is not desired that firms should use *pitch* or oil in their furnaces for this purpose of producing extra smoke."

Surely this was drafted by somebody with little or no knowledge of the comparative national values of pitch and, say, crude tar, and it may be assumed that the national position with regard to the glut of pitch could not have been known, and probably crude tar was meant instead of pitch. The Ministry of Home Security (Smoke Production Division) could be profitably enlightened on this position, and it would appear that here we have a temporary market for pitch, at least for the duration of the war, which would absorb the stocks of surplus pitch in this country at a price in excess of its former export value.

It only requires propaganda by an authoritative body such as The Institution of Gas Engineers to put the pros and cons of these facilities to the proper quarter.

The pitch could be pulverized and mixed proportionately with the coal or coke in steam raising plants to a definitely recommended formula according to the type of boiler, grate area, chimney draught, &c. Then we get immediately the results desired by the Ministry of Home Security (Smoke Production Division), and incidentally help the high-temperature carbonizers of coal to find a temporary new market for their pitch.

Such disposal of pitch would be better than stocking it, and parties who have fixed their contracts on a normal market quotation would not have to pay an interim sum on account and then fix upon a composite price to cover the period, when exports are renewed. We should be temporarily relieved of this waiting period.

Another aspect is the manufacture of briquettes of the ovoid type, by gas undertakings using their production of pitch mixed with coke breeze dust, which in most areas has always been a great drug on the market. Coke briquettes make an excellent fuel and can be very profitably produced by every gas undertaking, and would absorb all the pitch and coke dust produced at each works.

Here is an approximate estimated cost of manufacture of coke briquettes of the ovoid type at the rate of 10 tons per day of eight hours, suitable for a medium sized gas-works—say, upward of 200 million cu.ft. output:

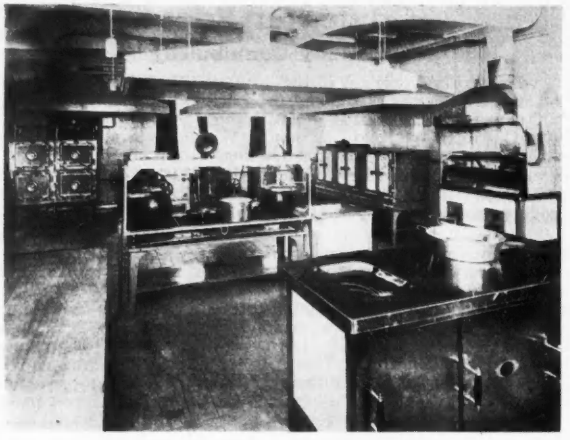
Estimated Cost.

	£	s.	d.
Materials.			
Pitch 20%, last average "JOURNAL" quotation, 50s.	5	0	0
Coke breeze, say, ¼ in. to dust at 7s. 6d.	3	0	0
Steam and water		10	0
Labour.			
Two labourers at 1s. 3d. per hour	1	0	0
Standing Charges.			
10 tons at 6d. per ton		5	0
Depreciation and Repairs.			
10 tons at 6d. per ton		5	0
Total cost for 10 tons	10	0	0

These ovoid briquettes could readily be sold in every area for at least £2 per ton and the plant could be run only when stocks accumulate, it being understood, of course, that each undertaking would have returned to his plant the proportionate amount of pitch derived from the particular works tar that had been distilled by the tar distillers, and charged at an agreed fair market price.

Sulphate of Ammonia Prices

The Control of Fertilizers (No. 4) Order, 1940 (S.R. & O., 1940, No. 1474, price 1d.), which has been made by the Ministry of Supply to take effect as from Aug. 15, specifies maximum prices for the sales of agricultural sulphate of ammonia in quantities of 2 cwt. or more. Enquiries should be addressed to the Controller of Industrial Ammonia, Ministry of Supply, 19, Berkeley Square, Bristol, 8.



In a new Royal Air Force Hospital, Fletcher, Russell & Co., Ltd., (Radiation Ltd.) have recently completed an installation of gas and steam-heated cooking apparatus. The equipment comprises apparatus for the main kitchen in the administration block, two kitchens in the regimental quarters, and one in the nursing sisters' quarters, as well as the supply of gas cookers in various ward kitchens. All the apparatus is finished in mottled porcelain enamel. A number of gas-heated incinerators have also been supplied in the surgical and medical quarters, &c. These, too, are finished in porcelain enamel.

Behaviour of Silica Bricks

Mr. H. M. Spiers, joint Author with Mr. C. Edwards of the Paper entitled "Anomalies in the Properties and Behaviour of Silica Bricks," part of which we published in the "JOURNAL" of Aug. 14, writes to inform us of certain corrections. They are as follows :

Table IV.—Column 3. Under 15418 (Sample Number), the Section Number should be 28, not 38.

Table V.—Column 2. Second line of figures. Section Number should be 9, not 8.

Columns 4 and 5, opposite Sample No. 15060. Section Number 3. The arrangement should be :

Sample Number.	Section Number.	Firing Temperature °C.	Quartz in Coarse Grains.	Cristobalite in Coarse Grains.
15060	3	—	Main constituent. Coarse grains much broken up.	Little present.

Page 285.—Left hand column. Line 2. For "attained" read "attains."

Table III.—The column headed "Raw Rocks" should extend over 3 sub-columns, thus :

Raw Rocks.		
Specific Gravity.		% Porosity.
True.	Apparent.	

Page 286.—Left hand column. Line 3. For "rick" read "rock."

Underground Gasification of Coal

An improved method for the underground gasification of coal has been worked out in the Power Institute of the Academy of Sciences of the U.S.S.R. by a group of scientists under the direction of Academician A. B. Chernyshev. The new method eliminates the need to sink shafts and drifts in preparation for underground gasification. Instead, two wells are sunk in the coal seam. After the combustion process is initiated underground, compressed air is blown into one well and gas issues from the other. The gas is then transported by pipe-lines to the consumer.

This method, said Academician Chernyshev in a Moscow newspaper, will find wide application in the underground gasification of coal deposits where the layers are horizontal and the shaft method now in use is difficult to employ.

Experiments with the new method carried out under laboratory conditions during the past year have yielded positive results, and it is now planned to try it out in the Moscow Coal Basin. The outcome of the experiments is of great importance for Moscow's fuel supply. If they prove successful, it will be possible, at a low cost, to obtain gas which will serve both as a fuel and as raw material for the chemical industry. Pipe-lines from the coal fields will conduct the gas directly to the different factories and mills.

Restrictions on Advertising Matter

New Paper Control Order

Certain provisions of a new Control of Paper Order may concern gas undertakings which are still carrying on local publicity. Among these provisions the following are quoted from the *Board of Trade Journal* :

No poster or portion of a poster exceeding 2,400 sq.in. may be printed on new paper, but a poster of larger size may be printed if the excess is printed on the back of old posters. Printing includes handwriting, the silkscreen process, or making by any other means. Old posters and parts of old posters may be exhibited with a newly printed part not exceeding 2,400 sq.in. in area. Posters advertising substantially identical matter must be at least 100 ft. apart if both can be seen at the same time. Posters relating to the sale of goods may be exhibited inside a shop. They may be exhibited elsewhere only on advertising space previously used for such posters, and then only if already printed before the date of the Order or if printed on paper acquired before May 27 for printing posters or if printed on the back of an old poster.

The restrictions on advertising circulars are increased, the weight that may be distributed being reduced to one-fifth of what was distributed in the corresponding three months of last year, but this weight may be made up to 56 lb. over the months November, December, 1940, and January, 1941, in order to enable the distribution of advertising calendars, diaries, &c., which have for the most part already been made. No advertising circulars may be distributed at all relating to goods which are specified in the Limitation of Supplies (Miscellaneous) Order, 1940—*i.e.*, goods which may be supplied to retailers only in limited quantities. Loose advertising matter may not be inserted in newspapers, magazines, and periodicals.

Wrapping and packing of articles, whether for wholesale or retail distribution, is limited to the extent required for the protection of the article, and the inclusion of advertising matter is prohibited.

New prohibitions on production apply to daily, weekly, and monthly calendars exceeding specified weights ; show cards ; display cards ; advertising novelties ; counter or window display devices ; dummy cartons ; visiting cards ; and programmes exceeding 200 sq.in.

The Order does not apply to export trade.

North British Association

Annual Meeting in Edinburgh

The Annual General Meeting of the North British Association of Gas Managers will be held on Friday, Sept. 6, at the North British Station Hotel, Edinburgh, at 10.30 a.m. Following the ordinary business of the meeting, two Papers will be read—by Mr. A. B. Munro, of Edinburgh, on "Some Observations on Policy," and by Mr. James M. Dow, of Kirkcaldy, on "Oxide Purification." Luncheon will be served at 1 p.m.

On Thursday, Sept. 5, a Golf Competition, under handicap rules, in aid of the Red Cross, will take place over the Baberton Course, while by courtesy of the Whitehouse and Grange Bowling Club, a Bowling Competition, in aid of the same funds, will be held on the Club's green, Hope Terrace, commencing at 2 p.m.

["Hull Daily Mail" photograph]

Heading a column of nine vehicles which recently took from Hull to a factory in the Midlands Hull's contribution of aluminium for aeroplanes was a gas-driven van belonging to the East Hull Gas Company. The second vehicle also was a Gas Company lorry. In all, over 6 tons of aluminium was sent to the factory 1,100 lb. of which had been collected by the Gas Company and stored in their showroom window. The owners of the transport vehicles had all volunteered to assist in conveying the scrap to its destination.

USE OF PITCH AS A FUEL

From the Journal of the Institute of Fuel

By
Ir. A. BARGEBOER

IN the April issue of the Journal of the Institute of Fuel last year a Paper by Mr. E. Brett Davies was published dealing with this subject. The Paper gave the impression that only *steam* or *air* atomizers may be used for the combustion of liquid pitch. In this respect I would draw attention to the fact that very recently we developed for the Royal Dutch Shell Company a new burner for burning very high melting asphalt, goudron, and the like.

In this burner the spraying of the fuel is performed by a mechanical atomizer of a novel design which has given most satisfactory results. The Author is of the opinion that this method of atomizing is superior to the steam or air method, for the following reasons:

(*a*) The steam or air cools the pitch very efficiently in the atomizer, as the fuel has a much higher temperature than the steam or air (250° and 350° C.).

(*b*) The atomizing of the fuel by the air or steam type atomizer is very unequal, or, in other words, the drops of the atomized fuel have a very different diameter.

As the combustion time increases very intensely with the drop diameter the larger drops have to travel a long distance through the very hot zone of the burning small drops. The consequence is that these coarser drops will easily be cracked and decompose

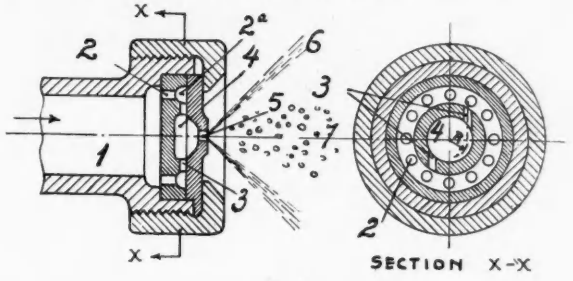


Fig. 1

to coke and soot particles. As the combustion time of these particles is rather long, the combustion gets poor.

Now our new atomizer has the special feature to produce a mist of very fine drops of nearly equal diameter. As this mist is spread into a hollow cone, the mixing with the combustion air is very complete. Moreover this atomizer is adjustable very easily within a wide range (1 to 10), which adjustment can be very easily controlled automatically.

For a clear understanding of the new atomizer a short introduction into the working of a so-called dynamical atomizer (or "whirl" tip) will be helpful. As starting-point we take the old tip as used in most of the well-known burners (Babcock-Wilcox, Wallsend, Howden, &c.) (Fig. 1). The fuel enters from the fuel pipe 1 through holes 2 into the ring-groove 2a, with a pressure of, say, 200 lb./sq.in. From this groove the fuel is forced through the tangential slots 3 into the whirl chamber 4, and flows to the centre of this chamber along spiral orbits.

According to the laws of mechanics, the velocity of rotation increases rapidly towards the centre, so that the velocity at the

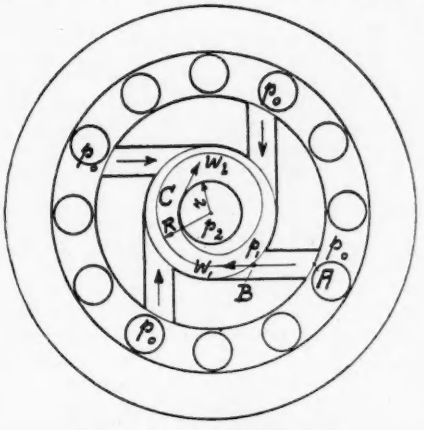


Fig. 2.—Flow in Whirl-Chamber

spray opening 5 with the radius r is many times the velocity at the circumference of the chamber with radius R. Due to this fact there is a high pressure difference between the circumference and the centre of the whirl chamber.

This remarkable fact may be calculated in a simple way (Fig. 2). The entrance velocity of the liquid into the whirling chamber (at B) is

$$w_1 = \alpha \sqrt{p_0 - p_1} \quad (\alpha = \text{a constant}) \quad . \quad . \quad . \quad . \quad (1)$$

where p_0 = supply pressure and p_1 = pressure at the circumference of the whirl chamber.

At the spiral flow of the liquid from B to C the velocity increases (if the viscosity is low) according to the law of moment of momentum, so that—

$$\frac{W_2}{w_1} = \frac{R}{r} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

where r and R are the radii of the spray opening and the whirl chamber respectively.

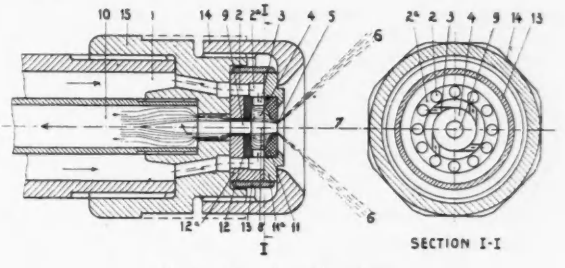


Fig. 3.—Bargeboer Atomizer

On the other hand, the velocity increase is calculated from the energy equation—

$$w_2^2 - w_1^2 = \alpha (p_1 - p_2) \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

As $p_2 \cong 0$ and according equation (2)

$$w_2 = w_1 \frac{R}{r}$$

(3) is transformed in

$$w_1^2 \left[\left(\frac{R}{r} \right)^2 - 1 \right] = \alpha^2 p_1.$$

According to equation (1) it results—

$$\alpha^2 (p_0 - p_1) \left[\left(\frac{R}{r} \right)^2 - 1 \right] = \alpha^2 p_1$$

so that

$$\frac{p_1}{p_0 - p_1} = \left(\frac{R}{r} \right)^2 - 1$$

and

$$\frac{p_0 - p_1}{p_0} = \frac{r}{R}$$

If, as in many cases,

$$\frac{r}{R} = \frac{1}{3},$$

then

$$\frac{p_0 - p_1}{p_0} = \frac{1}{9}$$

so that in that case the pressure drop in the tangential slots A, B is about $\frac{1}{9}$ of the supply pressure!

These facts are tested by experiments the results of which are incorporated in the graph, Fig. 5. From this it can be seen

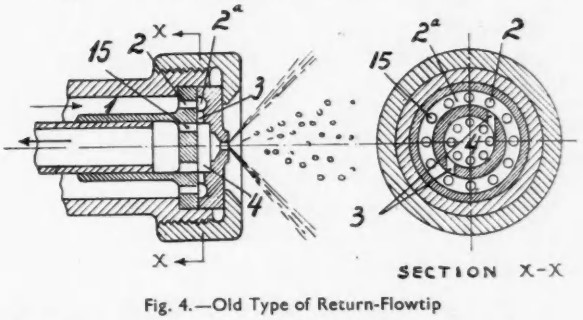


Fig. 4.—Old Type of Return-Flowtip

that only 10 to 20% of the pressure drop is caused in the tangential slots, and that in consequence the pressure at the circumference of the whirl space is about 80% of the original pressure. At half the radial distance between spray opening and circumference of whirl chamber the pressure drop is only 1 atmos., and at the last couple of millimeters the bulk of the pressure (12 atmos.) is transformed into velocity.

Returning to Fig. 1, owing to the foregoing fact the fuel leaves the spray opening as a rapidly rotating jet, which breaks up by centrifugal force into fine drips. As the centrifugal force quickly

diminishes towards the centre of the jet, the atomizing in the centre part is much coarser than at the circumference. In consequence of this, a flame is formed with good combustion at the sides, but long flame tips with often poor combustion in the central parts. Moreover this flame usually tends to instability.

It will be clear from the above investigation that the fault of the old atomizer is located in the centre of the jet. Now the first principle of the Bargeboer atomizer is the elimination of this fault, or, in other words, to form a stable, hollow, quickly rotating jet by increasing the rotational velocity to such an extent that a

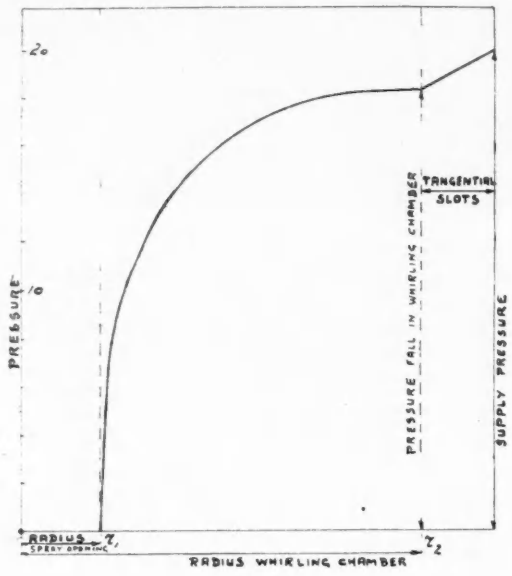


Fig. 5.

hollow space is formed in the centre part of the whirl chamber (Fig. 3). As the very great centrifugal force in such a hollow jet is the same for every part, the atomizing will be complete and uniform, but this effect cannot be achieved with the old type atomizer described in Fig. 1.

The solution of this problem is explained by reference to Fig. 3. Through the wide tangential slots 3 a far greater quantity of fuel is forced than is required for combustion, and the surplus is withdrawn from the whirl chamber through a central return opening 9, after it has given up its energy to the fuel to be atomized. By this principle the energy for forming the hollow spinning jet or film and high-grade atomization is available, while the cavity from which initiates the hollow jet is stabilized by the vortex formed in the central return opening 9 by the rotation of the returning fuel. That this effect is actually obtained is seen in the

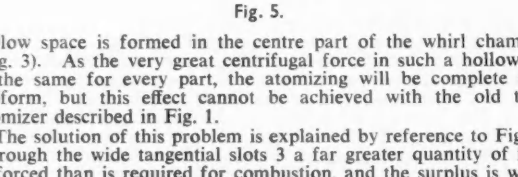
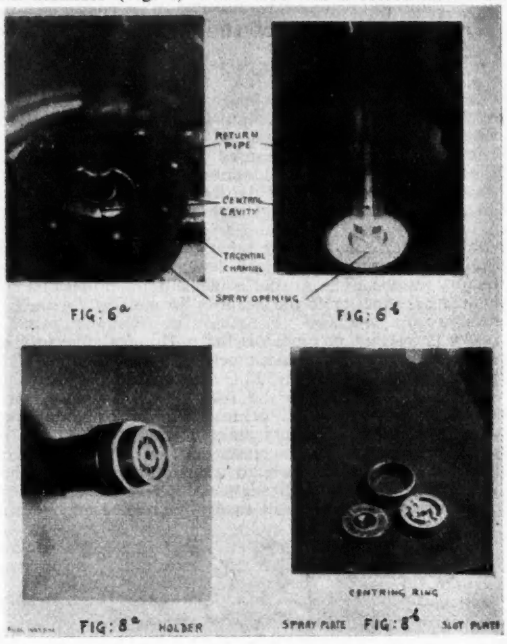


Fig. 6.—Old Type of Air Register

photos (Figs. 6*a*, 6*b*) of an atomizer constructed in glass, where the hollow cavity which reaches into the return pipe is very clearly seen.

Together with this effect of high grade and uniform atomization another effect is attained—namely, the wide range adjustability of the flame. Thus by checking more or less the amount returned, the quantity atomized increases or decreases. The construction makes it possible to have a linear relation between the return pressure (in 10, Fig. 3) and the quantity atomized.

As will be clear from the flow in the whirl chamber explained above, the pressure energy of the surplus fuel is transformed into velocity in the central part of the whirl chamber. Experiments made with an actual atomizer confirm this theory, and it is demonstrated in graph Fig. 5. From this it is clear that in another well-known atomizer (Fig. 4) which also has a return flow arrange-



ment by which the return fuel is withdrawn at the wrong place—namely, at the holes 15 at the circumference of the whirl chamber, in consequence of which 100% of the available energy is lost—perfect atomization cannot be obtained.

A typical feature of the new atomizer is that the capacity is only to a small extent dependent upon the supply pressure. Consequently these burners are working perfectly with duplex steam-pumps.

As indicated in the above account of the operation of the new atomizer, the velocity of the liquid in the whirl chamber is extremely high. Therefore it is essential that the wall of the whirl chamber be very smooth and corrosion resistant. To this end the Bargeboer atomizer has, therefore, a whirl chamber of ultra-resistant material—namely, tungsten-carbide. The construction is

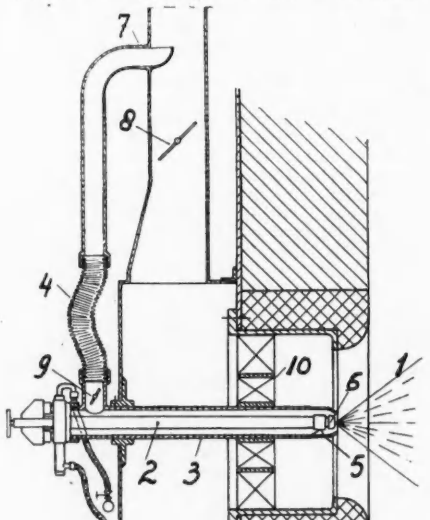


Fig. 7.—Device for Auxiliary Air-Supply

very simple and ensures an easy and perfect concentric mounting. The parts (Fig. 3) 11*a* and 12*a*, in which the tungsten-carbide parts 11 and 12 are soldered, are mounted in the centering-ring 13 and clamped by nut 14 into the tip-holder 15, which is screwed on to the fuel supply pipe 1 and the return connexion 10.

The Auxiliary Air-Supply ("Inner Air")

While the above-mentioned device may be applied to any air register, this special feature of the Bargeboer burner is dealt with separately. Its purpose is to obtain a very stable flame which burns

very near the tip so that perfect air mixing and complete combustion are obtained, and at the same time the troubles due to sooting and coking of the tip are eliminated. Instead of taking out the burners many times a day it is possible with this device to operate the burners continuously without any choking of the tips.

It will be appreciated from what follows that such a device is essential to obtain full advantage of really fine atomization, as without it the efficiency of any burner depreciates rapidly.

An explanation of the phenomena in the vicinity of the tip (Fig. 6) will make this clear. By the action of the atomizer (6) a continuous cone-shaped stream of fine fuel particles emerges from the spray opening. These fine drops are ejected at a high velocity and are in consequence subject to a high resistance on meeting the surrounding gases, which force diminishes the velocity of the fuel particles.

As the concentration and the velocity of the drops just in front of the tip (point 7) are very high, they induce a flow of very hot combustion gases into the partial vacuum created just in front of the atomizer, which ignites the fuel and gives rise to a very high temperature there. An intense cracking of the fuel at the tip results. This gives rise to the sooting and coking of the tip. As this starts at the edge of the spray opening the fine atomization is upset within a short time, giving rise to unsatisfactory combustion. Moreover, the eddying of the combustion gases causes flame instability.

Realizing these phenomena, the effect of the author's device for auxiliary air supply ("inner air") will be easily understood. The partial vacuum in front of the atomizer (the cause of all these troubles) is broken by leading a small quantity of auxiliary air around the tip which prevents the formation of any vacuum just in front of the atomizer. This device may be applied to any burner. Fig. 7 gives an instance of a special burner for steam boiler use. The atomizer barrel (2) is surrounded by a tube (3) with a restricted mouth (5) and which is connected to the pipe (4) where the air pressure is maximum. Consequently, the pressure at the restricted mouth (5) is higher than in the combustion chamber, so that a stream of auxiliary air flows in front of the tip and prevents any risk of vacuum formation. The quantity of this auxiliary air is very small (about 1% of the combustion air).

In the case of burners where the combustion air is preheated, such as in modern steam boilers, in which the auxiliary air is tapped off before the air preheater, the effect of this device is even more startling, as the above-mentioned phenomena in the vicinity of the atomizer are then most serious.

It goes without saying that with such burners the flames retain their fine atomizing qualities without the necessity of frequent removal of the burners. The result is a so-called "short flame" burner which causes no impingement on walls or other parts of the combustion chamber.

PIPELINE CORROSION CAUSED BY ANAEROBIC BACTERIA

Paper presented at the Pennsylvania Gas Association's Annual Convention

By

PAUL GANSER,

Philadelphia Electric Company

THE purpose of this Paper is to bring attention to a type of pipe corrosion which only recently has been recognized in the U.S.A., though it probably has been occurring for many years. This corrosion, which is entirely new to us, is technically called "microbiological anaerobic corrosion." It is not my desire to go into the technical problems involved in its study, but rather to give a brief description of the bacteria which cause this corrosion, part of their history, a résumé of the results obtained by various investigators, and the preventive measures which, at present, are known to be effective.

Our introduction to this type of corrosion came about last summer when the 16-in. transmission main in the yard of our Upper Darby Holder Station was uncovered in order to repair a leak that was killing the nearby grass and shrubs. In uncovering this main, which was laid in a low, wet, tight brown clay soil, the pipe was found to be severely corroded. The pits were very deep and irregular in shape, some being all the way through the pipe, and many others very nearly through. It was immediately thought to be caused by stray-current electrolysis, and A. V. Smith, of the United Gas Improvement Company of Philadelphia, was called upon to investigate the situation. No stray-currents were found serious enough to cause such severe corrosion. Tests made by Mr. Smith indicated the corrosion was due to the action of anaerobic bacteria, and he immediately arranged with Raymond F. Hadley, of the Susquehanna Pipe Line Company of Philadelphia, to make cultures from the corrosion products. These cultures were grown by Mr. Hadley and showed the bacteria to be present.

A few days after the above discovery, a second leak was found on a drip riser on the 20-in. transmission main outside our West Conshohocken Gas Plant. This main was laid in a low, saturated, rocky soil of very poor texture. In uncovering the drip stem, the leak appeared to be located at the water level in the ground. It was immediately thought to be caused by differential aeration, but as more of the drip riser became exposed, the corrosion appeared worse. It was then necessary to uncover the main and drip pot, which were found to be severely corroded. From our experience at the Upper Darby Holder Station, this leak was also thought to be caused by these microbes. Our opinion was verified by Mr. Hadley in cultures taken from the products of corrosion.

Size of Bacteria

These bacteria, which are known as sulphate-reducing bacteria, range in length from two to five microns and are approximately half a micron wide. For those who may not be familiar with the term "micron," it is the millionth part of a metre (39.37 in.). They can readily be seen under the microscope at 850 diameters magnification. In general, their shape is that of the spirillum (coil spiral) or vibrio (curve rod); but abnormal shapes are very often observed when subjected to sudden temperature changes, particularly when incubation is carried on at 115° F., or higher. Such abnormal shapes are usually long and sinuous, and eventually break down into a number of smaller microbes.

The wide temperature limits tolerated by these bacteria are shown by the fact the cultures have been grown from soil water taken from under ice in a ditch. They also have withstood temperatures as high as 176° F., provided they were not held at this high temperature for too long a period of time. In the laboratory, they are generally cultured from 68 to 86° F.

The sulphate-reducing bacteria should not be confused with the common iron bacteria which are aerobic; that is, the iron bacteria live in a water environment containing an abundance of dissolved oxygen. These iron bacteria often caused water companies considerable trouble by their growth within the mains, thereby reducing the flow of water.

The sulphate-reducing bacteria are strictly anaerobic, contributing to the corrosion of iron and steel only under conditions where free oxygen, such as in air or dissolved oxygen, is entirely absent. Although they play a part in the corrosion of metals only under anaerobic conditions, they can survive in aerobic locations for long periods of time.

Fundamentally, this corrosion may be expressed in the following manner. Iron, as other metallic elements, when placed in water or in a solution, has a definite tendency to go into solution in the form of electrically charged ions, but since a solution must remain electrically neutral, an equivalent number of similarly charged ions of some other element must somehow be displaced. Iron, when placed in water, immediately plates out the element hydrogen which gathers on the iron surface as a thin invisible film. This film of hydrogen normally tends to retard or stop this reaction, and may be explained in several ways. For example, the film may act as an insulator, separating the iron from the solution or, as it is built up, it may tend to go back into solution opposing the reaction. For the corrosion to proceed, it is necessary that this film of hydrogen be removed. This may be done by the hydrogen film combining with oxygen, when present in solution, forming water, or it can be by the bubbling off of the hydrogen as a gas. When iron is placed in water containing hydrogen sulphide, hydrogen is evolved and the product of corrosion is ferrous sulphide. Von Wolzogen Kuhr found that when iron was immersed in some water taken from the canals of Holland, hydrogen was actually consumed, instead of liberated as might have been expected. Von Wolzogen Kuhr's theory, in brief, is that these bacteria remove this hydrogen film which is utilized by them in the reduction of the sulphate ion, forming water and hydrogen sulphide. The sulphate ion is generally found in the soil water as calcium sulphate. The ferrous ion is then precipitated by the hydrogen sulphide as ferrous sulphide as a product of this corrosion.

The entire process, as represented by Von Wolzogen Kuhr, is given in the following equations:

$$8H_2O \longrightarrow 8H^+ + 8OH^-$$
$$4Fe + 8H^+ \longrightarrow 4Fe^{++} + 8H$$
$$H_2SO_4 + 8H \longrightarrow H_2S + 4H_2O$$
$$Fe^{++} + H_2S \longrightarrow FeS + 2H^+$$
$$3Fe^{++} + 6OH^- \longrightarrow 3Fe(OH)_2$$
$$4Fe + H_2SO_4 + 2H_2O \longrightarrow Fe(OH)_2 + FeS$$

(Summary Equation)

The other product of this corrosion shown in the summary equation is ferrous hydroxide, a white, pasty substance (which

oxidizes and slowly turns brown when exposed to air). As this ferrous hydroxide can be formed by other corrosion processes, it is eliminated as a true indicator of the activity of these microbes. On the other hand, ferrous sulphide, a relatively hard, black chemical salt somewhat similar to carbon in appearance, can be formed on the metal surface only by the method just mentioned, and is therefore a true indicator of this bacterial attack. This, of course, is where the water surrounding the metal is neutral.

If by pouring hydrochloric acid over the products of corrosion, hydrogen sulphide is evolved, it is a definite indication that one of the products is ferrous sulphide and the bacteria are contributing to the corrosion at that location. The hydrogen sulphide can easily be detected by its obnoxious odour; but as this gas is extremely toxic, care should be exercised in conducting this test. It is well to use lead acetate paper as a safety measure for this purpose. This paper is white, but will turn black when moist and exposed to hydrogen sulphide gas. Other products of this corrosion are, for the most part, hydroxides, carbonates, and small quantities of oxides.

In adding hydrochloric acid to oxide or hydroxide, no gas is evolved; but when added to carbonate, carbon dioxide (an odourless gas) is evolved. In the field, the tests mentioned above are convenient and quick, but quantitative analyses of the corrosion products are much more desirable in the study of these microbes.

There are a great many bacteria that possess the property of producing hydrogen sulphide, but only a limited number can reduce the sulphates to sulphides. The various strains of the sulphate-reducing bacteria differ from each other by their temperature, salt, and organic food characteristics; the latter being the most significant classification. They are gram-negative when stained with gram's stain, and may be viewed with the bright field of the microscope. By this colouring process, the various groups may be distinguished more readily. The specii we are chiefly interested in are the *Sporovibrio desulfurican* genera.

The reduction of thiosulphate to hydrogen sulphide by bacteria was first reported by Holschewnikoff in 1889, while Petri and Maassen likewise reported similar reductions in 1893. Beijerinck, in 1895, was the first microbiologist to make a systematic study of the sulphate-reducing bacteria and to attribute this reaction to a specific bacteria. Since then, many other bacteriologists have studied the sulphate-reducing bacteria in respect to specii differentiation and culture. Starkey made an important and far-reaching investigation of their morphological characteristics, while Von Wolzogen Kuhr, in Holland, and Bunker, in England, were the first to study their role in the corrosion of cast-iron.

Development of Research

It is interesting how the research of the sulphate-reducing bacteria and their contribution to the corrosion of steel came about in this country. Mr. Hadley, who has previously been mentioned, was responsible for this work, and has written two very interesting Papers on his findings, which appear in the Sept. 21, 1939, issue of the *Oil and Gas Journal*, and the March and April, 1940, issues of the *Petroleum Engineer*.

In 1937, Mr. Hadley found the corrosion of his company's pipelines in the swamps and lowlands through the State of Ohio of such a serious nature that it was decided to make a complete analysis of the problem. In many cases, the metal had been corroded from the pipe in such large slabs it was necessary to design a special bar, used in conjunction with the standard micrometer pit depth gauge, in order to find the depth of the slabbed area. The soil resistivities were measured, and in some instances, were found to be as high as 10,000 ohms. This, of course, is generally taken as ideal soil for a pipeline. A section of pipe on each side of a swamp was then calibrated to read the current flow in the pipe. By simultaneously reading the current flow in the pipe on one side with that on the other, it was easily determined whether the pipe was losing or gaining current in the swamp. This was done by means of short wave radios stationed at each calibrated section. In some instances, it was found the pipe was picking up current from the swamp, instead of losing it, as might have been expected. As a further check, the electrical discharge of the pipe was measured by the Pearson earth current meter. The maximum current density, shown by this meter, was insufficient to cause serious corrosion of the pipe for a much greater number of years than had elapsed. The products of corrosion were entirely ferrous, occurring as sulphides, hydroxides, and carbonates. The soil water showed the presence of sulphate. The pH of the soil water was found to be between 6.4 and 7.8, which is neutral. All the factors ordinarily used as a criterion in determining the causes of corrosion had been used and indicated the pipe should be in excellent condition. Visual examination, however, showed the corrosion to be so severe that it was necessary, in many cases, to replace the pipe. The only conclusion that would have been feasible was that some of the chemical salts found in the soil water must have undergone a reduction process to form the products of corrosion that were present on the pipe.

Mr. Hadley and his associates, while attending the Corrosion Conference held at Washington, D.C., in 1937, heard the Paper given by Dr. Von Wolzogen Kuhr on the "Corrosion of Cast Iron Buried in the Swamps and Lowlands of Holland." He attributed this corrosion to the sulphate-reducing bacteria. On hearing this Paper, Mr. Hadley and his associates immediately connected this type of corrosion with the trouble they were having throughout the State of Ohio. Since this time, a complete research of this sulphate-reducing bacteria has been made by Mr. Hadley. This study revealed a number of surprising things caused by these bacteria, many of which had formerly been attributed to other types of corrosion.

The pH previously mentioned, is an expression used to determine the acidity or alkalinity of a solution. The pH of pure water is 7.0 and the gradual decrease in this number denotes an increase in the acidity, whereas the higher the number the more alkaline the solution.

Block Colour Comparator

Due to the erratic results obtained by using litmus and nitrazine papers to determine the acidity or alkalinity of the soil water, the LaMotte Block Colour Comparator was employed. The basic theory of this comparator is that the colour changes of the indicator used will be distinguishable even when put in solutions having some colour. The indicator most suitable for determining the pH of soil water in this area is bromthymol blue, which has a range of 6.0 to 7.6 pH. If pH values beyond this range are desired, other indicators must be used. At locations where sufficient water is available, test tubes should be rinsed thoroughly in order to dilute any salts left by previous determinations. In cleaning the test tubes, which are made of alkaline-free glass, use water, preferably distilled. If necessary, a wet cloth may be used, followed by distilled water rinses.

From Mr. Hadley's investigations, it has been found that there are two deciding factors in locating this corrosion, and these have been formulated into the following rules.

1. It is necessary that the earth be water-saturated or air-tight. To define this rule more clearly—it was noted that although these bacteria usually attack where the ground is saturated, they have been found in places where there was practically no water. When there is any degree of rapidity in the motion of the water, as through sand or gravel, their attack has been seriously retarded or stopped. It has also been learned that where the pipe extends into well aerated soil, or where the pipe is laid near or on the surface of the ground, no corrosion is found.
2. The pH of the soil water must be approximately 7.0, the limiting deviation of which is $\pm$ 0.8 pH.

Although these sulphate-reducing bacteria have been isolated beyond the limits mentioned in rule 2, they are not in such locations actively participating in the corrosion of the metal.

If all conditions of these two rules are fulfilled, bacterial attack may or may not be present, depending primarily upon the organic foods available in the soil water. In order to prove definitely whether there are any bacteria present, it is necessary to uncover the main and use the hydrochloric acid test on the products of corrosion.

In taking samples of the products of corrosion, it is extremely important that they may be taken under water, as the sulphide is very unstable and oxidizes almost immediately when exposed to air. Make a hole along the side of, and under the pipe, leaving a good quantity of soil over the corrosion products. Place a jar in the hole and fill it with water from the ditch; then remove the soil and scrape the products of corrosion from the pipe into the container. Invert the jar cap and place on the jar, the whole process being done under water to insure against the entrance of oxygen.

Wide Sulphate Concentration Limits

No correlation of the sulphate concentration and carbon dioxide tension with corrosion has been noticed to date, as the number of locations tested has been limited; but it is hoped that, in the near future, additional data may clarify any relationship that may exist. It is known that the sulphate concentration limits are wide, ranging from one part per million to approximately two thousand parts per million; but so far, little difference has been noticed in the severity of the corrosion.

TABLE I.

State and County.	No. of Test Holes Examined.	Avg. Distance Between Test Holes Feet.	Avg. No. of Ft. of Pipe Examined per Test Hole.	% of Test Holes Undergoing Bacterial Attack.	Portion of Total Pipe Requiring Protection, Due to Bacterial Attack 1936-43, in %.
PENNSYLVANIA :					
Delaware	30	1,470	7.9	6.7	32.4
Chester	136	1,120	7.5	12.5	38.1
Lancaster	113	1,442	7.2	18.6	53.6
York	78	1,886	6.4	20.6	70.9
Adams	162	905	6.3	25.3	43.3
°Franklin	102	936	6.2	41.8	96.6
°Cambria-Somerset	23	2,004	6.2	26.0	32.0
°Westmoreland ...	135	1,424	6.6	27.4	70.4
Allegheny	111	1,536	7.2	26.2	79.2
Beaver-Lawrence ...	89	1,626	7.5	41.5	61.1
°Schuylkill	82	640	7.7	14.6	20.1
OHIO :					
Columbiana ...	7	1,194	9.6	14.3	54.2
Mahoning	112	1,507	7.6	51.7	80.2
°Portage	54	998	9.9	48.5	63.2
Summit	107	797	8.4	54.2	70.8
NEW YORK :					
Onondaga	203	773	6.5	72.9	89.9

° Counties not complete; that it, test holes have been dug from county line to county line.

Sometimes the bacteria produce a favourable environment soon after the pipe is laid, although it may take three or four years, depending upon the anaerobic condition of the soil; but once active growth has started, the maximum life of the pipe will be approximately 7 to 10 years. One hundred per cent. attention and protection of the pipe is necessary in practically all locations where this bacterial attack is found. The rate of corrosion is nearly three times that of other types, with the exception of carbon contact, stray current electrolysis, and concentrated acid.

Table I, taken from Mr. Hadley's Paper, published in the March, 1940, issue of the *Petroleum Engineer*, shows the seriousness of this corrosion.

The only known method of protection is to box the pipe in pitch or some similar compound. This means building a wooden box about the pipe, using a special vitrified tile cleat on both sides and under the main to keep it free of the box. This special vitrified tile, which has a moisture content of less than 0.1%, is used so that no moisture can reach the surface of the pipe. Although other materials can be used for this purpose, the tile has been found to be the most practical. The box is then filled with pitch so that at least 2 in. of pitch surrounds all metal. Always backfill the ditch with a good compact soil, and at locations where the pipe is already in place, backfill to the top of the box before pouring the pitch. It is strongly advised that an experienced person be in charge of this work in order to ensure satisfactory and permanent installation.

Value of Boxing

Several corrosion technologists have questioned the value of boxing, as they were not convinced that a good bond could be made between the pitch and the pipe, and the pitch and the tile cleats. They also stated that as the box deteriorated, the pitch (having a cold flow) would run off the pipe. The inspection of numerous locations in which the sulphate-reducing bacteria have been particularly active has, however, rather conclusively disproved the above statements, especially if a cold primer is applied to the pipe before pouring the pitch.

Because the pitch has a cold flow, it depends primarily upon the condition of the wooden box to keep it from flowing off the pipe, although a backfill of a good, compact soil is also important in preventing this. The boxing was inspected in many locations where these bacteria have been exceedingly active. The wood used in most cases was the cheapest grade of pine which, according to the wood tables, has a maximum life of 10 years in water. Some of the boxing examined had been buried in the ground for over nine years and was still in excellent condition. This may be explained by the fact that under anaerobic conditions, where oxygen is entirely absent, the wood is preserved. Therefore, it can be seen that the use of a wood more suitable to water conditions, such as cypress, would make the life of the box indefinite.

The investigators have also been questioned on the value of the hydrochloric acid test previously explained. Some technologists maintain that the sulphur impurities in the pipe itself may be sufficient to give off hydrogen sulphide. If this were true, ferrous sulphide should be found at all locations; whereas, in the inspection of many places where bacterial corrosion was not present, no sulphur in any form could be detected. In instances where the bacteria had been actively operating, the total sulphur found in the corrosion products ranged from 2% to 5%.

There are 32 organic compounds or foods known at this time that can be utilized by these bacteria as hydrogen donators. In nature, many of these compounds are derived from sewage or decomposition and fermentation of plant remains. The complete list of these organic compounds can be found in Mr. Hadley's paper published in the March, 1940, issue of the *Petroleum Engineer*. Some of the most common of these foods are formatic, acetic, asparic, and stearic acids, saccharose, ethyl alcohol, glycerol, and mannitol. This list covers the most prominent in each of the following groups that are utilized by these microbes as hydrogen donators; such as, the fatty acids, the alcohols, and the carbohydrates. The quantity of organic food available, therefore, serves as a good indicator of the severity of this corrosion.

To prove this fact by example, in the laying of the Sun Oil line in Ohio, a large tree buried in a swamp interfered with the course of a pipe. Rather than lower the pipe to go under the tree, a piece was cut out of the tree, large enough to allow the pipe to go through. In the recent inspection of this line, it was noted that where the tree had been cut away, the pipe was severely corroded for approximately a foot on either side of the tree. In another instance, a piece of hemp rope was left lying on top of the pipe when it was laid. When this was later uncovered, the complete outline of the rope was corroded into the pipe. Many other similar examples were discovered.

Summary Reaction Equation

From the equation representing the summary reaction of this corrosion process of Von Wolzogen Kuhr, it can be seen that three out of four molecules of iron are precipitated as ferrous hydroxide and only one as ferrous sulphide. In actual experience, this result was not obtained, but this may be explained by the fact that the metal is not the only hydrogen donator for these bacteria. The following equation shows they can utilize the hydrogen in the organic food where sodium lactate is taken as the organic food.

$$2C_3H_5O_3NA + 3CaSO_4 \longrightarrow Na_2CO_3 + 3CaCO_3 + 2CO_2 + 2H_2O + 3H_2S.$$

This additional hydrogen sulphide is then available for the precipitation of more ferrous ions as ferrous sulphide. Therefore, it was found that where there is an abundance of organic food, more ferrous sulphide is formed and less ferrous hydroxide.

Our own experience with this corrosion is an excellent example that where there is a large quantity of organic food available there is more of the sulphide formed. At West Conshohocken, there were large quantities of organic food present, and practically all the corrosion products consisted of ferrous sulphide. Only traces of the ferrous hydroxide were present. At the Upper Darby Holder Station, where there was little organic food present, large quantities of ferrous hydroxide were found and small quantities of ferrous sulphide.

At both the Upper Darby and the West Conshohocken Plants, the mains had been treated with protective coatings when they were laid. The soil resistivities at both locations were measured with the "Shephard Rods" and ranged from 6,000 to 8,000 ohms per cu.cm. The pH of the soil water was also approximately the same, 6.9 and 7.0 respectively. The sulphate concentrations in the soil water varied greatly, being 32 parts per million at Upper Darby against 1,982 parts per million at West Conshohocken. The 16 in. main in the first location, had a pipe wall thickness of $\frac{1}{4}$ in. and was 11 years old before it failed. In comparison, the 20 in. West Conshohocken main had a pipe wall thickness of $\frac{5}{16}$ in., and gave only seven years of service before its failure.

The differences in the pipe life may be explained in several ways. The West Conshohocken main was laid in much deeper and more saturated ground, making its condition considerably more anaerobic. This, of course, aids the microbes in making an environment more quickly, resulting in their earlier contribution to corrosion. The variation in the thickness of the pipe wall may have been a factor. The larger quantity of organic food at West Conshohocken should also be considered. It is possible the sulphate concentrations have an effect on the pipe life which, however, has not been ascertained at this time.

Laboratory experiments are now being made to determine if, by cathodic protection, this bacterial attack can be retarded or stopped. The basic theory used in the experiments is that the pH of the soil water, and the solution in the pits, can be raised to a figure sufficiently high to inhibit bacterial growth. The current density required for this protection will, of course, depend upon the kind of metal salts in the soil water, and the effectivness of the current density in changing the pH of the solution in the pits where the microbes are present in high concentrations.

Street Lighting for the Winter

Modified street lighting, including many gas units, has been installed in many London districts during the summer and will be in use during the coming winter.

In Islington and Hackney most of the main roads have already been equipped. In St. Pancras, where main roads and side streets are to be lighted, more than 50% of the work has been done. Tottenham is also to have lighting in every street; the side streets are being equipped first. The main roads will be dealt with afterwards.

Hampstead still has the 12 experimental lamps in Haverstock Hill and Belsize Avenue; the Council have not yet decided whether to extend the system. Hornsey, Finchley, and Edmonton have no lighting yet, but Edmonton Council are expected to consider the matter at their next meeting. At Hendon an extensive scheme has been prepared, but nothing has been done yet.

Burnley W.G.C. Activities

The Burnley Branch of the Women's Gas Council held a meeting and concert at the Mechanics Institute recently, when nearly 200 members attended. Mrs. A. F. Ames, wife of the Gas Engineer and Manager, is President of the Branch, and she outlined the progress of the Branch since its formation in January, 1939. In the first year the membership was 210; to-day it was 235.

Referring to the wartime activities of the Branch, Mrs. Ames said that thanks to the sales of wartime cookery books, several whist drives and other social functions, they had a credit balance, in spite of the fact that nearly £30 had been spent on parcels and comforts sent to men serving with the Forces and donations to war charities.

During the concert which followed donations to the town's Spitfire Fund totalled £7 6s.

Gas Heated Circulators

A patent has been granted to Maxol Heaters, Ltd., and W. Lomax (No. 523,817; application date, Jan. 16, 1939) relating to improvements in gas-heated circulators.

Fig. 1 is a side elevation partly in section of the apparatus.

The apparatus is in the form of an outer casing A open at the bottom and closed at the top by a removable cowl D and an inner casing C open at the top and bottom, a space being formed between the two casings up which part of the hot gases from the burners B can pass, the burners being arranged inside the outer casing A and below the inner casing C.

Two parallel rectangular or substantially rectangular, tubes E^1 and E^2 separated by a space are arranged transversely in the upper part of the chamber formed by the inner casing C. The tubes E^1 and E^2 are supported by two castings or pressings e^1 and e^2

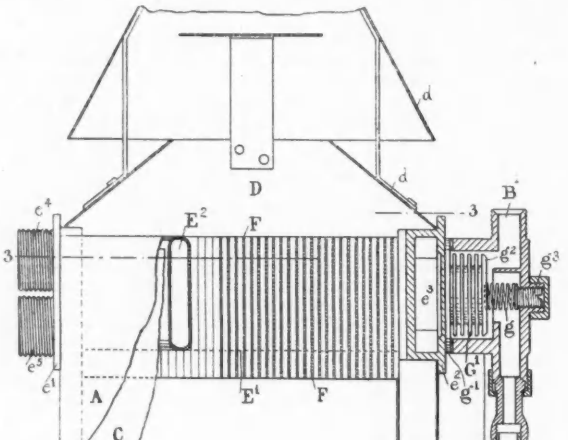


Fig 1

one at each end of the tubes secured to the end walls of the casing B, the casting or pressing e^2 being provided with a cavity e^3 to form a header to allow the water to flow from one tube to the other. The other casting e^1 is formed with two unions e^4, e^5 connecting with the tubes E^1 and E^2 respectively. The union e^4 connected to the tube E^1 is connected to the water inflow pipe from the storage tank or cylinder and the union e^5 connected to the tube E^2 to the return pipe to the tank or cylinder. The circulating water thus flows from the storage tank or cylinder through the tube E^1, the header e^3, the tube E^2 and back to the tank or cylinder.

The space between the two tubes E^1 and E^2 contains a series of plates or fins F arranged at right angles to the walls of the tubes and brazed, soldered, or otherwise secured to the outer surfaces thereof. These plates or fins F preferably extend for the whole depth of the tubes E^1 and E^2 and lie in the main path of the hot gases from the burners B. They thus form heat exchangers between the hot gases and the water flowing through the tubes E^1 and E^2, and owing to their large combined area promote a very efficient heating of the water flowing through the tubes.

A thermostat is carried by the header casting e^2 to control the temperature of the water by operation of a valve in the gas supply pipe B^1 to the burners B. The form of thermostat shown in the drawing consists of an expanding metal bellows G^1 under the influence of a spring g, one end g^1 of the bellows being in contact with the wall of the header, and the other forming or carrying the closure member g^2 of the gas control valve. The spring g is preferably capable of adjustment by the screw g^3 for regulating the desired temperature of the water. In operation as the temperature of the water increases the bellows G^1 expand until when the maximum temperature is reached the closure member g^2 of the valve is pressed on to its seating and the supply of gas to the burners B is cut off.

A by-pass burner B^2 is arranged in close proximity to the burners B and is fed by the pipe b^2 independently of the supply pipe B^1 to the burners B. This by-pass burner should be maintained continuously alight so that if the burners B are extinguished by the complete closing of the valve g^2 they will be re-lighted as soon as the temperature of the water falls below the maximum for which the thermostat is set. As a safeguard, however, for preventing the escape of gas through the burners B should the by-pass burner B^2 become extinguished for any reason, a safety valve J is arranged in the gas supply to the burners B. The safety valve J is controlled by a bi-metallic strip j in or adjacent to the flame of the by-pass burner B^2. So long as the burner is alight, the bi-metallic strip j will hold the valve J open but should it become extinguished the cooling of the strip will cause the valve J to close and the supply of gas to the burners B prevented.

The cowl D at the top of the apparatus is preferably in the form of two truncated cones with a baffle d in the upper cone.

Heat Radiating Elements

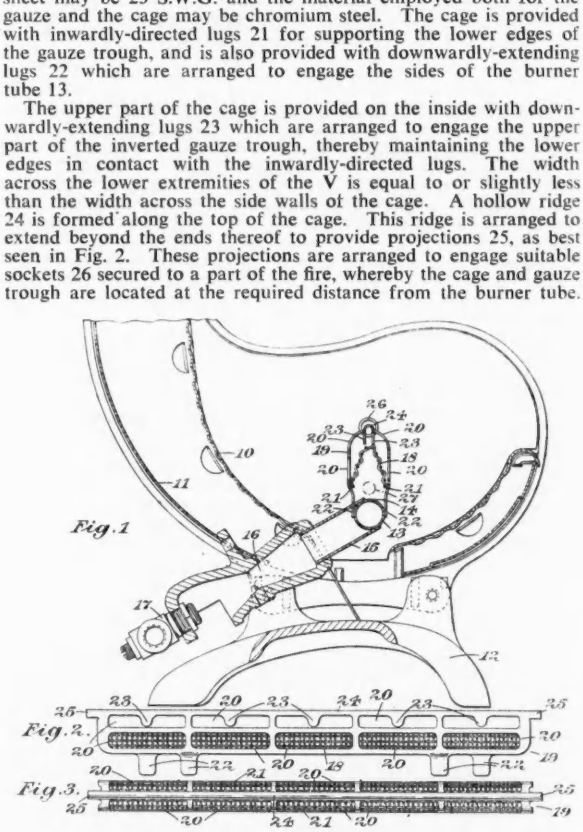
Among the new patents is one taken out by R. and A. Main, Ltd., and G. W. Wortley. This patent (No. 524,062; application date, Jan. 20, 1939) concerns heat-radiating elements for gas fires.

Fig. 1 is a vertical cross-section through the heat-radiating element and also through a part of the gas fire; Fig. 2 is a front elevation of the heat-radiating element; and Fig. 3 is a plan of the construction shown in Fig. 2.

The heat-radiating element is arranged for use in a gas fire having a reflector 10 which is supported in front of a back-plate 11 mounted on a framework 12. The element is supported above a horizontally-disposed burner tube 13 having a row of burner orifices 14 along the top thereof. The burner tube is fed with air-gas mixture by means of a supply conduit 15 which communicates with a mixing chamber 16 and injector 17.

The element comprises a strip of heat-resisting metal gauze bent into the form of an inverted V-shaped trough 18 located within a sheet-metal cage 19. The edges of the gauze are strengthened by welding the cross-strands of wire together. The selection of the gauge of the wire and the size of the mesh in the heat-resisting metal gauze is of considerable importance, in order to obtain maximum luminosity without smothering the flame and without so overheating the wire as to cause fracture. Good results are obtained when the gauze is formed from heat-resisting wire of 23 S.W.G. and having a mesh of 10 strands per inch. The cage is formed from sheet-metal bent into the form of an inverted U and having its side walls and preferably also its upper wall formed with a number of slots 20, as best seen in Fig. 2 and 3. The gauge of the sheet may be 23 S.W.G. and the material employed both for the gauze and the cage may be chromium steel. The cage is provided with inwardly-directed lugs 21 for supporting the lower edges of the gauze trough, and is also provided with downwardly-extending lugs 22 which are arranged to engage the sides of the burner tube 13.

The upper part of the cage is provided on the inside with downwardly-extending lugs 23 which are arranged to engage the upper part of the inverted gauze trough, thereby maintaining the lower edges in contact with the inwardly-directed lugs. The width across the lower extremities of the V is equal to or slightly less than the width across the side walls of the cage. A hollow ridge 24 is formed along the top of the cage. This ridge is arranged to extend beyond the ends thereof to provide projections 25, as best seen in Fig. 2. These projections are arranged to engage suitable sockets 26 secured to a part of the fire, whereby the cage and gauze trough are located at the required distance from the burner tube.



If desired, additional heat-radiating means may be located within the inverted gauze trough. For example, a wire helix 27 may be arranged in the mouth of the trough immediately above the row of burner orifices.

In order that the flames from the burner may be supplied with sufficient secondary air, the lower edges of the gauze trough require to be spaced a certain distance away from the top of the burner. In the case of a burner having burner orifices 0.06 in. diameter, the

lower edges of the trough are disposed $\frac{1}{32}$ in. away from the top of the burner. The top of the trough is arranged about 1 in. from the top of the burner. The height of the trough is thus about $\frac{3}{32}$ in. As already indicated, it is rounded at its top and its radius of curvature is about $\frac{1}{8}$ in. The width across the lower edges of the trough is slightly less than $\frac{5}{8}$ in. The overall height of the inverted U-shaped cage is about $1\frac{1}{32}$, and its radius of curvature at the top is $\frac{5}{16}$ in. For a 10 in. radiating element, each side wall of the cage is provided with five slots separated by $\frac{1}{8}$ in. bars, the height of which slots is about $\frac{3}{8}$ in. The rounded portion at the top of the cage is also provided with two rows of five slots separated by a ridge $\frac{3}{16}$ in. in width. The rows of slots in the rounded part are separated from the rows of slots in the side walls by bars $\frac{1}{8}$ in. in width.

Two downwardly-extending lugs 22 are provided at the bottom of each side of the cage so that the lugs on one side are in staggered relation to the lugs on the other side.

British Standard Specifications

Steel Conduits and Fittings

The British Standards Institution has just issued the revision of B.S. 31-1933 for Steel Conduits and Fittings for Electrical Wiring. This revision was undertaken principally with the view to clarifying the position of the lugs relative to the spout outlets in small circular boxes, while the table giving the dimensions of the entry bushes has also been slightly amended.

Copies of this British Standard (No. 31-1940) may be had from the British Standards Institution, 28, Victoria Street, S.W.1; price 2s. 3d., post free.

Material to Provide a Minimum Standard of Protection against Incendiary Bombs

The above Specification which has just been issued by the B.S.I. has been prepared by the British Standards Institution in response to a demand for materials and treatments of comparatively low cost which would afford a useful degree of protection against incendiary bombs, though not necessarily as high as that required of materials conforming to BS/ARP 27, Testing Incombustible Material Resistant to Incendiary Bombs.

The specification fixes a standard of protection such that materials conforming therewith will—

(a) Markedly reduce the lateral spread of fire on protected surfaces.

(b) Markedly retard or even prevent entirely the outbreak of a destructive fire.

(c) Markedly reduce the damage to protected timber floors, usually confining it to the slow burning and charring of a square foot or so of boarding.

It is emphasized, however, that the adoption of protection to the standard fixed by this specification does not obviate the necessity for active defence against bombs by the stirrup hand-pump or other fire-fighting appliances. By retarding the effects of the bomb the time during which a bomb or resultant fire may be effectively dealt with is appreciably extended. Further, when a bomb has ignited in a protective space charring of the protected timber will have occurred and glowing timber may be present. It is essential, therefore, that after the bomb has been extinguished the protective material must be removed locally and access then made to the underside of the timber so that effective measures may be taken to extinguish any smouldering that may be present.

Copies of the standard (BS/ARP 47) may be obtained from the British Standards Institution; price 4d., post free.

Black Bolts and Nuts

The attention of members of The Institution of Gas Engineers is directed to the publication of a new British Standard for Black Bolts and Nuts.

This Specification has been prepared at the request of the Ministry of Supply to secure the utmost economy in steel consumption. It is in addition to the well-known B.S. 28 for Black Bolts and Nuts of Whitworth Form, and it provides for black bolts having heads and nuts smaller than the full Whitworth sizes given in that Specification.

The Specification has been prepared in full consultation with the manufacturers, and it is estmated that the manufacture of bolts and nuts to this new standard will effect a saving of some 60,000 tons of steel per year. The dimensions of the heads and nuts are those of the next smaller nominal size in the Whitworth series, and permit of the use of existing spanners. The dimensions are, therefore, in effect those which have been long recognized for bright B.S.F. bolts and nuts, and "auto-whit" bright bolts as laid down in B.S. 191 and 193. An interesting feature of this War Emergency Specification for black bolts and nuts is that it makes provision for both the B.S. Whitworth and B.S. Fine Thread.

Copies of this new British Standard (B.S. 916-1940) may be obtained from The Institution of Gas Engineers, 1, Grosvenor Place, London, S.W.1, or from the British Standards Institution: price 2s. 3d., post free; for quantity orders special discounts are available.

Gas Undertakings' Results

Hawick

It was reported at the annual meeting of the Hawick Gas Company that the quantity of gas sold during the past twelve months had been 134,374,000 cu.ft., which compares with sales amounting to 117,299,000 cu.ft. in the preceding year. During the year the remainder of the retort bench was reconstructed, and a waste-heat boiler installed. This is being followed by a modern tar distillation plant. The profit for the year is £2,456, and the dividend is at the rate of 4¼%. With the amount brought in, there is a balance to be carried forward of £5,044.

Kirkcaldy

It has been reported to a meeting of the Kirkcaldy Town Council that the past financial year's accounts in connexion with the Gas Department closed with a deficit of £87. Notwithstanding the almost entire loss of income from street lighting, the receipts from sales of gas, at £44,159, exceeded both the preceding year's actual and this year's estimated figure. The Reserve Fund, from which last year's deficit was met, has a credit balance of £16,048. The Council approved a new tariff of charges for gas.

Mansfield

The gas undertaking of the Mansfield Town Council, which on the preceding year's working realized a profit of £2,037, for the past year records a loss of £283. This is in spite of the fact that there have been increased sales of gas amounting to 10,543,000 cu.ft.

Selkirk

The accounts presented to the annual meeting of shareholders of the Selkirk Gas Company showed that the profit resulting from the past year's working was much the same as that for the preceding year. The payment of a dividend at the rate of 5¼% was approved.

Shrewsbury

The Directors of the Shrewsbury Gas Light Company, in their report for the year ended June 30, state that there has been an increase of 28,500,000 cu.ft. in the volume of gas sold; the quantity made during the year having been 402,677,300 cu.ft. At the end of June there were 12,047 consumers, of whom 8,697 were furnished with prepayment meters. The price of gas was increased from 11d. to 1s. per therm as from the readings of the meters for the December quarter, to meet the increased cost of coal and other materials. The balance carried to Profit and Loss Account is £16,732, which compares with £14,070 a year ago. On the present occasion there is a total available for distribution of £12,741, and after payment of a dividend of 6¼% for the year (the same as last year) there will remain a balance to be carried forward of £9,297. The balance brought in was £8,662.

Stockton-on-Tees

Sales of gas by the Borough of Stockton-on-Tees Gas Department during the twelve months to March 31 show a decrease of 3.74% when compared with those of the preceding year, the actual total having been 647,700,000 cu.ft., as against 672,900,000 cu.ft. Subsequent to the relaxation of the rationing conditions, the domestic consumers still continued to limit their consumption to a minimum. However, the severe cold spell in January resulted in a greatly increased demand on the productive capacity, while additional wartime industrial uses of gas have also assisted in limiting the decrease in consumption. After careful review of the estimates for the current twelve months, a new scale of charges for gas was fixed, embodying, as from April 1, an all-round increase of approximately 10%. An 18-in. main connecting Stockton and Middlesbrough was completed last September, and is ready for use if required. On the present occasion the net profit to Revenue Appropriation Account is £12,342 as against £13,783 a year ago. From this, the sum of £1,690 is devoted to meters, cookers, and water heaters, and the Reserve Fund is increased by the maximum amount permissible (£3,279), leaving a balance of £7,373 to be carried forward.

Workington

The quantity of gas made by the Borough of Workington during the year ended March 31 was 178,782,000 cu.ft., and of coke oven gas purchased 31,388,000 cu.ft.—giving a total of 210,170,000 cu.ft. This is a decrease of 7.55% on the output of the preceding year, due to restrictions caused by the war and the effect of the higher calorific value of the gas supplied. As a matter of fact, during the five months ended Aug. 31, 1939, an increased output of 3.88% was recorded. The coke oven gas supply was inaugurated last November, with the taking of a partial supply from the coke ovens of the Workington Iron and Steel Company. The scheme is now practically complete, and the manufacture of coal gas has ceased. At the end of the financial period the number of meters connected in the gas supply area was 8,199, and of the total gas registered 61.86% was supplied through prepayment meters. The result of the year's working is a net deficit of £1,363, which compares with a net profit of £287 for the previous year. The undertaking is in the unusual position of selling gas below pre-war rates, owing to the increased calorific value of the gas now supplied.

THE
WALKER
GAS HEATER
ASSISTS
PURIFICATION
BY
UTILIZING
WASTE HEAT
IN
EXHAUST STEAM

SUITABLE ALSO FOR LIVE STEAM

MADE IN SIZES FROM 6" UPWARDS

C. & W. WALKER LTD.

'Phone : Lilleshall-Shropshire Nos. 34 & 35 (2 lines).

DONNINGTON
WELLINGTON—SHROPSHIRE
'Grams : "Fortress," Donnington, Shropshire.

London Office - Temporary Address: DONNINGTON, WELLINGTON, SHROPSHIRE.

GASHOLDERS

GUIDE FRAMED — SPIRAL
WATERLESS
(KLONNE)

39, VICTORIA STREET, WESTMINSTER, S.W.1
ABBEY 3121
RETORTUS, SOWEST, LONDON

PURIFIERS
CHEMICAL PLANT
WASHERS & SCRUBBER
STEEL TANKS
CONDENSERS

COAL & COKE
HANDLING PLANT
GENERAL STEEL
CONSTRUCTIONAL
WORK

PROVIDENCE IRONWORKS
MILLWALL, E.14
EAST 5231 & 5232
CUTLER, MILLWALL, LONDON

SAML CUTLER & SONS LTD.

LONDON

482

Gas Products Prices

The London Market

Aug. 26.

There is little of interest to record in the London Tar Products market, current values being as under: Pitch remains nominal, creosote is about 4¾d. to 5d. per gallon, refined tar 3¾d. to 4d., the price of pure toluene under the Ministry of Supply Toluene No. 2 Order is 2s. 5d. per gallon, pure benzole 1s. 10d., 95/160 solvent naphtha 1s. 11d. to 2s., and 90/160 pyridine about 18s. 6d., all per gallon naked, refined naphthalene crystals £23 per ton in bags, all *ex* Makers' Works.

The Provinces

The average prices of gas-works products during the week were: Pitch and Crude Tar.* Toluole, naked, North, 1s. 9½d. (Controlled by the Ministry of Supply Order No. 1, which fixes the maximum price at which this material may be sold). Coal tar, crude naphtha, in bulk, North 9d. to 9½d. Solvent naphtha, naked, North, 1s. 8d. to 1s. 9d. Heavy naphtha, North, 1s. 4½d. to 1s. 5½d. Creosote, *ex* works, in bulk, North liquid and salty, 4¼d. to 4¾d.; Scotland, 4¼d. to 4¾d.; low gravity, 4½d. to 4¾d. Fuel Grade, 4d. to 4¼d. Carbolic acid, 60's, 3s. 6d. to 3s. 7½d. Naphthalene, £15 to £20. Salts, 75s. to 85s., bags included. Anthracene, "A" quality, 4½d. to 4¾d. per minimum 40% purely nominal. Heavy oil: Unfiltered anthracene oil, (min. gr. 1,080), 5¼d. to 5½d.; filtered heavy oil (min. gr. 1,080), 5¾d. to 6d.; heavy anthracene oil gr. less than 1,080, 6d. to 6¼d.

*The impossibility of giving a crude tar price, in the absence of any market price for pitch (which comprises 50-60% of a ton of crude tar), has, we understand, raised difficulties in the case of a number of contracts which are based upon the price normally given in the "JOURNAL" from week to week. Our Market Correspondent is not prepared to give a "nominal" price for pitch, upon which a tar price could be based; there was, we believe, trouble in the Courts over such a price at the end of the last War. Our Correspondent suggests that parties might perhaps agree among themselves upon a price to be paid on account, on the understanding that when there is again a market for pitch we should try to fix upon a composite price to cover the period which has intervened, and also give what we think would be a fair price for tar, based upon that figure, for each month of the period during which no prices for crude tar have been inserted. We shall be grateful if interested parties will write to us giving their views upon such an arrangement, so that if there is any consensus of opinion we can act accordingly.

Scotland

GLASGOW, Aug. 24.

If anything activity has been slightly greater during the week, and prices generally are fairly steady.

Refined tar.—Home requirements are relatively small, and price is unchanged at 4¼d. to 4½d. per gallon. For export quotations are maintained at 3½d. per gallon, both f.o.r. naked.

Creosote oil.—A fair throughput is maintained at the following prices: Specification oil, 5d. to 5¼d. per gallon; low gravity, 6d. to 6½d. per gallon; neutral oil, 5¾d. to 6d. per gallon; all *ex* Works in bulk.

Cresylic acid.—Not much interest is being taken in this product, and supplies are procurable as under: Pale, 97/99%, 1s. 11d. to 2s. per gallon; Pale, 99/100%, 2s. 2d. to 2s. 4d. per gallon; Dark, 97/99%, 1s. 7d. to 1s. 9d. per gallon; all *ex* Works in buyers' packages.

Crude naphtha is well looked after at 6½d. to 7½d. per gallon *ex* Works in bulk, according to quality.

Solvent naphtha.—90/160 grade is 1s. 8½d. to 1s. 9d. per gallon, and 90/190 heavy naphtha is 1s. 4½d. to 1s. 5½d. per gallon.

Motor benzole is 1s. 8d. to 1s. 8½d. per gallon.

Pyridine.—90/160 grade is 17s. to 18s. per gallon, and 90/140 grade is 19s. to 20s. per gallon.

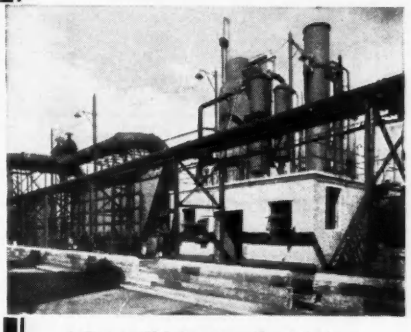
Results at Walsall

The Gas Fund Accounts of the County Borough of Walsall for the year ended March 31 show a fall in income of about £5,000, to £156,660, with a rise in working costs of a little more than this amount, to £136,905. Loan charges are nearly £1,000 up, with the result that the total expenditure has risen from £164,071 to £170,171, and the net deficit on the year's working is increased from £2,363 to £13,511.

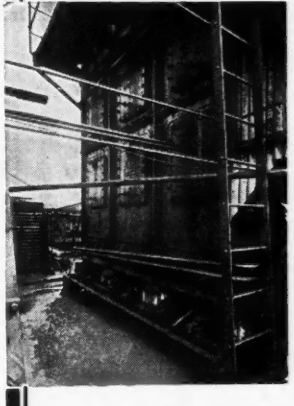
THIS WEEK'S ADVERTISERS

	PAGE
Alder and Mackay, Ltd.	380
Bale & Church, Ltd.	381
Blakeley, Firth, Sons, & Co., Ltd.	382
Bratt Colbran, Ltd.	349
British Gas Purifying Materials Co., Ltd.	382
British Thomson-Houston Co., Ltd.	355
Cohen, George, Sons & Co., Ltd.	382
Cowan, W. & B.	Cover III
Crookston, S., & Co.	380
Cutler, Samuel, & Sons, Ltd.	376
Danks of Netherton, Ltd.	354
Dempster, Robert, & Sons, Ltd.	382
Dick, R. & J., Ltd.	347
Donkin Co., Ltd. (The Bryan)	Cover II
Dry Gasholders, Ltd.	352
Ellison Insulations Ltd.	382
Ether, Ltd.	347
Evans, Joseph, & Sons (Wolverhampton), Ltd.	348
Expanded Metal Co., Ltd.	355
Fluxite, Ltd.	382
Frost, A. E.	382
Gas Meter Co., Ltd.	348
Gas Purification and Chemical Co., Ltd.	381
Gibbons Bros., Ltd.	353
Glenboig Union Fireclay Co., Ltd.	351
Glover, George, & Co., Ltd.	345
Glover, Thos., & Co., Ltd.	Cover I, 358
Goodall, Clayton, & Co., Ltd.	Cover IV
Green & Boulding, Ltd.	382
Griffiths Bros. & Co. (London), Ltd.	367
Hamilton, Archd. H., & Co., Ltd.	354
Holmes, W. C., & Co., Ltd.	383
Horseley Bridge and Thos. Piggott, Ltd.	351
Humphreys & Glasgow, Ltd.	356
Keay, E. C. & J., Ltd.	384
Keith Blackman, Ltd.	384
King, Walter, Ltd.	381
Kings Patent Agency, Ltd.	381
Kirkham, Hulett, & Chandler, Ltd.	380
Kleenoff Co.	381
Lench, Thos. W., Ltd.	381
London Electric Firm, The	380
Main, R. & A., Ltd.	370
Menno Compressed Air Greasecup Co., Ltd.	354
Mewburn, Ellis, & Co.	381
Mitchell, H., & Co.	354
Newton Chambers & Co., Ltd.	364
Oxley Engineering Co., Ltd.	Cover II
Parkinson, W., & Co.	358
Peckett & Sons, Ltd.	354
Pulsometer Engineering Co., Ltd.	Cover IV
Radiation, Ltd.	368, 369
Reavell & Co., Ltd.	380
Ruscoe, John, & Co., Ltd.	354
Siebe, Gorman, & Co., Ltd.	380
Sperryn & Co.	357
Stein, John G., & Co., Ltd.	352
Strachan & Henshaw, Ltd	345
Terry, Herbert, & Sons, Ltd.	354
Thomas & Bishop, Ltd.	377
Trotter, Haines, & Corbett, Ltd.	381
Walker, C. & W., Ltd.	376
Waller, Geo. & Son, Ltd.	346
West's Gas Improvement Co., Ltd.	378
West's Piling and Construction Co., Ltd.	Cover IV
Willey & Co., Ltd.	350
Woodall-Duckham Co., Ltd.	363
Appointments Vacant and Wanted	382
Patents	381
Plant, &c.	382
Plants, &c., Wanted and for Sale	382

Every Joint Sound!



"Permac" Joints in a Gas Works.



"Permac" Joints in a Gas Works.

Ever since 1913 "PERMAC," the original Metal-to-Metal Jointing, has been holding up difficult joints like these in important Gas Works and on Coke Oven Plants all over the world. Equally suitable for any joint—steam, water, gas, oil — screw pipe or flange.

Send for particulars

Permac
METAL-TO-METAL JOINTING MATERIAL

Sole manufacturers:—

THOMAS & BISHOP LTD
37, Tabernacle St, LONDON, E.C.2

Telephone: Clerkenwell 3351 (2 lines)

For every size of works and every class of coal...

WEST'S

CARBONIZING PLANTS

GLOVER-WEST VERTICALS

WESTVERTICAL CHAMBERS

440 carbonizing plants have been built or are under construction by West's in 24 countries. Working results from a wide variety of gas coals have established the high efficiency and adaptability of the West systems.

WEST'S

GAS IMPROVEMENT CO · LTD ·

MILES PLATTING MANCHESTER 10

TELEPHONE—COLLYHURST 2961-2-3-4-5 · TELEGRAMS—STOKER, MANCHESTER

LONDON OFFICE TEMPORARY ADDRESS—BATH ROAD · HARMONDSWORTH · WEST DRAYTON · MIDDLESEX TEL.—WEST DRAYTON 2288-9

GAS STOCKS AND SHARES

There was little change in the general conditions on the Stock Exchange last week, business continuing on a very small scale. In fact, since speculation has been practically eliminated and business confined to genuine investment and forced sales, the number of transactions is so few that the smallest purchase or offer is sufficient to increase or reduce the price of any particular stock to an alarming extent. British Government stocks, however, maintain a firm and steady position and all closed slightly higher on the week—2½ per cent. Consols being ¼ up at 73¾. There was some irregularity in the miscellaneous market and a few of the leaders eased a little before the week-end. Oils were steady and the rubber and tea groups, although unsupported, showed a firm undertone. Mining shares were dull and featureless.

The gas market fared no better than the other sections so far as the volume of business was concerned. It will be seen in the lists below, however, that, apart from the seasonal ex div. reductions, prices remained firm and the majority of the changes were in an upward direction. Gas Light units advanced another 3d. to 14s. 9d. and on the local Exchange Newcastle units rose a like amount to 16s., while Imperial Continental closed 5 points up at 39½. Inquiry for Alliance and Dublin took the quotation 15 points higher to 110.

At the time of writing there are parcels of nearly all the leading ordinary stocks on offer and some good yielding preference issues, but very little debenture stock is available. Among the preference stocks on offer appear the following:

Amount offered. £		Price £	Gross Flat Yield % £ s. d.
500	Associated Gas and Water 4½% red	17s. ...	5 5 10
25,000	British 5½% red.	115 ...	4 15 8
250	Brighton and Hove 4%	81 ...	4 18 9
70	Commercial 4% red.	91 ...	4 7 5
2,000	Gas Light 4%	77 ...	5 3 10
500	Mid Southern 4%	77 ...	5 3 10
210	South Eastern Corpn. 4%	14s. ...	5 14 3
1,000	South Metropolitan 4%	72 ...	5 11 1
3,710	South Suburban 4%	73½ ...	5 8 10
2,600	do. 5%	91 ...	5 9 9
2,650	Wandsworth 4%	72 ...	5 11 1

Quotations on the London and Provincial Stock Exchanges

OFFICIAL LIST

Issue. £	When ex-Dividend.	Dividends. Pref. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Aug. 23.	Rise or Fall on Week.
1,767,439	Mar. 11	8	7	Alliance & Dublin Ord. ...	105—115	+15
374,000	July 1	4	4	Do. 4 p.c. Deb. ...	90—95	...
957,608	May 13	5	5	Asscd. Gas & Water U'd'ts Ord.	12/—14/	...
500,000	,,	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	15/6—17/6	...
535,545	,,	4	4	Do. 4 p.c. Red. Cum. Pref.	14/6—16/6	...
336,646	,,	4	4	Do. 4 p.c. Irred. Cum. Pref.	12/—14/—	...
361,370	Aug. 12	7	7	Barnet Ord. 7 p.c.	111—116	...
300,000	Apl. 8	1/4⅘	1/9⅘	Bombay, Ltd.	19/6—21/6	...
690,407	Agu. 19	7	7	Bournemouth 7 p.c. max ...	108—118*	−2
362,025	June 17	4	4	Do. 4 p.c. Deb. ...	90—95	...
659,955	Aug. 19	6¾	4⅘	Brighton, &c., 5 p.c. Con. ...	67—77*	−3
855,000	Mar. 11	7	8	Brit. Gas Light Ord.	77—87	...
545,000	June 17	5½	5½	Do. 5½ p.c. 'B' Cum. Pref.	110—115	...
120,000	,,	4	4	Do. 4 p.c. Red. Deb.	75—80	...
10,000	Nov. 6, '33	6	4	Cape Town, Ltd., 4½ p.c. Cu. Pf.	½—¾	...
626,860	July 15	5⅞	6	Cardiff Con. Ord.	89—94	...
24,500	Apl. 8	7	7	Colombo Ord. 7 p.c. Pref. ...	19/6—21/6	...
764,169	Mar. 26	/11.48	−/11.48	Colonial Gas Assn. Ltd. Ord. ...	14/6—16/6	...
400,000	,,	1/3.30	1/3.30	Do. 8 p.c. Pref. ...	20/—22/—	...
1,748,935	July 22	2	3	Commercial Ord.	37—42	...
620,000	June 10	3	3	Do. 3 p.c. Deb.	58—63	...
286,344	Aug. 19	5	5	Do. 5 p.c. Deb.	88—93*	...
807,560	Aug. 12	7	6	Croydon sliding scale	87—92	...
644,590	,,	5	5	Do. max. div.	90—85	...
620,385	July 1	5	5	Do. 5 p.c. Perp .Deb. ...	90—95	...
179,500	Aug. 19	5⅝	5	East Surrey 'B,' 5 p.c.	75—80*	−5
176,461	June 17	5	5	Do. 5 p.c. Deb. (Irred.)...	90—95	...
250,000	July 8	4	6	Gas Consolidation Ord. 'B' ...	13/—15/—	...
250,000	May 13	4	4	Do. 4 p.c. Red. Cum. Pref.	15/—17/—	...
19,152,410	July 29	3⅜	4½	Gas Light & Coke Ord. ...	14/3—15/3a	+/3
2,600,000	,,	3½	3½	Do. 3½ p.c. max.	54—59	...
4,477,106	,,	4	4	Do. 4 p.c. Con. Pref. ...	73—78	...
2,993,000	July 8	3¾	3¾	Do. 3¾ p.c. Red. Pref. ...	78—83	...
8,602,497	June 3	3	3	Do. 3 p.c. Con. Deb. ...	65—70	...
3,642,770	,,	5	5	Do. 5 p.c. Red. Deb. ...	99—104	...
3,500,000	,,	4½	4½	Do. 4½ p.c. Red. Deb. ...	98—103	...
700,000	Mar. 11	3¼	3¼	Do. 3¼ Red. Deb. ...	80—85	...
5,600,000	May 13	4	8	Imperial Continental Cap. ...	37—42	+5
43,820	July 29	3½	3½	Do. 3½ p.c. Red. Deb. ...	63—68	...
231,978	Aug. 19	5	5	M.S. Utility 'C' Cons.	68—73*	−2
918,657	,,	4	4	4 p.c. Cons. Pref.	72—77*	−3
675,000	May 6	†4	†4	Montevideo, Ltd.	52—57	...
300,000	Apl. 29	9	7	Oriental, Ltd.	100—110	...
368,537	June 3	7	8	Plymouth & Stonehouse 5 p.c.	90—100	...
621,667	Aug. 19	8½	7½	Portsmouth & Gosport Cons.	97—102*	−3
648,999	Apl. 29	1/1½	1/1	Severn Val. Gas Cor. Ld. Ord.	14/—16 −	...
597,972	Mar. 11	−/10⅛	−/10⅛	Do. 4½ p.c. Cum. Pref. ...	16/—18/—	...
2,528,714	April 29	1/2⅜	1/−	South East'n Gas Cn. Ld. Ord.	11/—13/—	...
1,000,000	Mar. 4	−/10⅛	−/10⅛	Do. 4½ p.c. Red. Cum. Pref.	14/—16/—	...
1,068,869	,,	4	4	Do. 4 p.c. Irred. Cum. Pref.	13/—15/—	...
6,709,895	Aug. 5	4	4	South Met. Ord.	50—55*	+1
1,135,812	,,	6	6	Do. 6 p.c. Irred. Pref. ...	98—108	...
850,000	,,	4	4	Do. 4 p.c. Irred. Pref. ...	70—75	...
1,895,445	July 1	3	3	Do. 3 p.c. Perp. Deb. ...	60—65	...
1,000,000	July 15	5	5	Do. 5 p.c. Red. Deb. ...	95—100	...
1,543,795	July 22	3	4	South Suburban Ord. 5 p.c. ...	60—70	...
512,825	July 8	5	5	Do. 5 p.c. Perp. Pref. ...	88—93	...
500,000	,,	4	4	Do. 4 p.c. Perp. Pref. ...	71—76	...
250,000	,,	3¾	3¾	Do. 3¾ p.c. Red. Pref. ...	80—85	...
888,587	June 10	5	5	Do. 5 p.c. Perp. Deb. ...	95—100	...
750,541	Aug. 19	5½	5	Southampton Ord.	68—73*	−2
350,000	Feb. 12	5½	5½	Swansea 5½ p.c. Red. Pref. ...	90—95	...
1,076,495	Aug. 5	5	5	Tottenham & District Ord. ...	68—78	...
338,555	,,	5	5	Do. 5 p.c. Pref.	88—93	...
453,380	June 10	4	4	Do. 4 p.c. Perp. Deb. ...	78—83	−4
1,247,505	May 20	4	6	U. Kingdom Gas Cor. Ord.	12/—14/—	...
1,085,952	May 13	4½	4½	Do. 4½ p.c. 1st Cum. Pref. ...	14/—16/—	...
772,709	,,	4	4	Do. 4 p.c. 1st Red. Cum.Pref.	14/—16/—	...
745,263	June 17	4½	4½	Do. 4½ p.c. 2nd Non.Cum. Pf.	12/6—14/6	...
1,200,000	Mar. 18	3½	3½	Do. 3½ p.c. Red. Deb. ...	83—88	...
380,606	Aug. 5	7	6⅝	Uxbridge, &c., 5 p.c.	93—98	...
1,371,138	July 8	3½	4	Wandsworth Consolidated ...	67—72	...
2,525,768	,,	4	4	Do. 4 p.c. Pref.	67—72	−3
1,343,964	June 17	5	5	Do. 5 p.c. Deb.	90—95	...
383,745	,,	4	4	Do. 4 p.c. Deb.	80—85	...
558,342	July 15	6	5	Watford & St. Albans Ord. ...	88—93	...
300,000	June 10	3½	3½	Do. 3½ p.c. Red. Deb. ...	85—90	...

SUPPLEMENTARY LIST

Issue. £	When ex-Dividend.	Dividends. Pref. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Aug. 23.	Rise or Fall on Week.
351,685	June 17	5	5	Brighton, &c., 5 p.c. Perp. Deb.	90—95	...
28,700	,, 17	5½	5½	Do. 5½ p.c. Red. Deb. 1942 ...	96—101	...
415,250	,, 17	4	4	Bristol Gas Co., 4 p.c. New Deb.	85—90	...
140,205	July 29	7	7	Cambridge, &c., 7 p.c. Cons. 'B'	100—110	...
295,932	Aug. 19	5	5	Cheltenham, 5 p.c. Cons. Ord....	88—93*	−2
42,500	July 1	4	4	Do. 4 p.c. Perp. Deb....	82—87	...
150,000	Aug. 12	4	4	Croydon Gas, 4 p.c. Pref. (Irr.)	70—75*	...
130,000	July 1	4	4	Do. 4 p.c. Deb. ...	75—80	...
146,700	Aug. 19	5½	5½	East Surrey, 5½ p.c. Pref. 'A' ...	95—110*	−7½
53,220	,, 19	6	6	Do. 6 p.c. Cum. Pref. ...	100—110*	−5
117,425	Feb. 5	8	8	East Wight, 5 p.c. Cons. Ord. ...	100—110	...
...	Aug. 19	6	4	Eastbourne, 'B' 3½ p.c.... ..	65—75*	−5
239,135	July 8	5	5	Gas Consolidation 'A' Ord. (£1)	13/6—15/6	...
156,600	Aug. 19	5	5	Hampton C't, 5 p.c. Cons. Ord.	68—73*	−9½
18,000	June 10	7	7	Malta & Med'n., 7 p.c. 1st Pref.	60—65	...
10,845	,, 10	7½	7½	Do. 7½ p.c. 2nd Pref.	60—65	...
50,000	Aug. 19	£5 19 6	£5 4 6	Mid. South. Util., 'A' Cons. 5 p.c.	63—73*	...
65,000	Aug. 12	5	5	North Middlesex, 5 p.c. Pref. ...	85—90*	...
70,000	Mar. 11	5	5	Plymouth & Stone., 5 p.c. Deb.	90—95	...
76,501	July 1	4	4	Reading, 4 p.c. Perp. Deb. ...	75—80	...
74,777	April 1	4	4	Romford, 4 p.c. Debs. (Reg.) ...	85—90	...
21,000	June 10	5	5	Slough, 5 p.c. Perp. Deb. ...	90—95	...
211,740	,, 17	5	5	Southampton, 5 p.c. Red. Deb.	96—101	...
363,575	July 1	5	5	Tottenham, 5 p.c. Reg. Red. Mt.	95—100	...
202,019	Mch. 18	7½	6¾	Tunbridge Wells, 4 p.c. Scale ...	70—80	...
135,257	June 10	5	5	Uxbridge &c., 5 p.c. Perp. Deb.	90—95	...

PROVINCIAL EXCHANGES

347,756	July 26	6	5	Bath Cons.	98—103	...
122,577	Feb. 19	7	7	Blyth 5 p.c. Ord.	109—111	...
1,667,250	July 15	5	5	Bristol, 5 p.c. max.	90—92	...
120,420	June 17	4	4	Do. 1st 4 p.c. Deb.	94—96	...
415,250	,,	4	4	Do. 2nd 4 p.c. Deb. ...	92—95	...
328,790	,,	5	5	Do. 5 p.c. Deb.	108—111	...
157,150	Aug. 5	6½	5	Chester 5 p.c. Ord.	98—101	...
92,500	June 17	4	4	Do. 4 p.c. Pref.	80—85	...
36,430	,,	3½	3½	Do. 3½ p.c. Deb.	80—85	...
41,890	,,	4	4	Do. 4 p.c. Red. Deb. ...	94—98	...
542,270	Feb. 12	6	9	Derby Cons.	103—108	...
55,000	June 10	4	4	Do. 4 p.c. Deb.	96—102	...
10,000	Aug. 19	10	10	Great Grimsby 'A' Ord. ...	170—180*	...
6,500	,,	10	10	Do. 'B' Ord. ...	170—180*	...
79,000	,,	10	10	Do. 'C' Ord. ...	160—170*	...
732,000	Feb. 19	4	4	Hartlepool G. & W. Cn. & New	63—68	...
2,167,410	Aug. 19	6	6	Liverpool 5 p.c. Ord.	96—98*	−2
245,500	June 17	5	5	Do. 5 p.c. Red. Pref. ...	97½—100½	...
306,083	July 15	4	4	Do. 4 p.c. Deb.	99—101*	...
20,000	June 24	5	5	Long Eaton 5 p.c. Pref. ...	9—11	...
80,000	June 24	5	5	Do. 5 p.c. Deb.	100—105	...
2,430,267	July 29	5 7/10	5	Newcastle and Gateshead Con.	15/6—16/6a	+−/3
682,856	,,	4	4	Do. 4 p.c. Pref.	73—75	...
776,706	Dec. 27	3½	3½	Do. 3½ p.c. Deb.	80—85	...
277,285	April 24	5	5	Do. 5 p.c. Deb. '43 ...	97—102	...
274,000	July 26	5	5	Newport (Mon.) Ord.	89—93	...
13,200	Mch. 26	7	8⅔	Pontyp'l Gas & W. 10 p.c. 'A'	11½—12½	...
13,600	,,	5	6	Do. 7 p.c. 'B'	9½—10½	...
40,000	,,	5	6	Do. 7 p.c. 'C'	9½—10½	...
106,280	Aug. 5	8	10	Preston 'A' 10 p.c.	157—167	...
188,219	,,	7	7	Do. 'B' 7 p.c.	113—123	...
1,806,339	Feb. 26	6½	6½	Sheffield Cons.	119—122	...
95,000	July 8	4	4	Do. 4 p.c. Deb.	97— 99	...
332,351	Feb. 5	6	6	Sunderland 6 p.c. max. ...	107—112	...
140,778	Aug. 12	5	5	Weston-super-Mare Cons. ...	87—90	−1½
64,338	June 24	4	4	Do. 4 p.c. Deb.	90—95	...
33,340	,,	7½	7½	Do. 7½ p.c. Deb.	140—150	...

a.—The quotation is per £1 of Stock. * Ex. div. † Price free of income-tax.

There is no better way of searching out faulty meters than house to house testing with an

"A & M"

DRY TEST METER

"A & M" Dry Test Meters are made in 40, 100 and 200 cubic feet sizes—the 40 cubic feet size weighing only 13½ lbs. Leather handles are fitted for ease of carrying.

The pointer shows the hourly rate by a minute's observation on the outer circle and 1 cubic foot in 100th parts on the inner.

We also manufacture Dry Demonstration Meters for Showroom use.

ALDER & MACKAY LTD.

EDINBURGH - LONDON - BRADFORD & BRANCHES

ERECTION WORK

GAS HOLDERS. OIL TANKS. STEEL BUILDINGS. CAST IRON TANKS. PURIFIERS. MAIN LAYING. PAINTING.
Sub Contractors for any Erection Work.
REPAIRS, RE-SHEETING, DISMANTLING, & RE-ERECTION INSPECTIONS.

S. CROOKSTON & CO.
Contractors
HORNTON, BANBURY, OXON.

COMPRESSORS & EXHAUSTERS FOR AIR AND GAS.
See our Advertisement Next Week.

REAVELL & CO. LTD. IPSWICH.

KIRKHAM, HULETT & CHANDLER LIMITED
GAS ENGINEERS
UNION FOUNDRY, MANSFIELD, NOTTS.
FOR GAS PURIFICATION PLANT
ROTARY WASHER SCRUBBERS, CONDENSERS, CENTRIFUGAL WASHERS, TAR EXTRACTORS, "GLYCERIN" GAS DRYING PLANTS, BENZOLE PLANTS, STATIC WASHERS, AND STEELWORK OF ALL DESCRIPTIONS.

London Office:—
Norfolk House,
Norfolk Street,
Strand, W.C. 2

Telephone:—
Temple Bar 2943
Telegrams:—
Washer, Estrand, London

Telephone: Uplands 4671/2

"Everything for Safety Everywhere."

SMOKE HELMETS. GAS MASKS.
BREATHING APPARATUS OF ALL PATTERNS.
OXYGEN RESUSCITATING APPARATUS.
FIRE EXTINGUISHERS. FIRST-AID OUTFITS.
SAFETY AND PROTECTIVE APPLIANCES OF ALL DESCRIPTIONS.

SIEBE, GORMAN & CO. LTD.,
WESTMINSTER BRIDGE ROAD, LONDON, S.E.1.
Telegrams "Siebe, Lamb, London" Telephone No.: Waterloo 6071

CONTENTS

EDITORIAL NOTES.

It Does Happen 403
Out of the Limelight 403
Crude Tar Prices 404

Gas Journal Directory 404
Personal 404
Obituary 404
Forthcoming Engagements 404

Wales and Monmouthshire Association ... 405
On to the Five Million 405
Gas Undertaking Results 405
Interesting Example of District High-Pressure Storage 406
Enamels and Glazes—Preparation, Drying and Firing 407
Anomalies in the Properties and Behaviour of Silica Bricks. A Paper Presented at a Recent Meeting of the Refractory Materials Section of the British Ceramic Society. By C. Edwards and H. M. Spiers 411

Trade News 417

Products Prices 419
Dividend Announced 419

Gas Stocks and Shares 421
Stock and Share Lists 421

TERMS OF SUBSCRIPTION.—*United Kingdom and Ireland: Advance Rate 35/- per annum; 18/- per half year. Credit Rate: 40/- per annum; 21/- per half year. Dominions and Colonies and United States: 35/- per annum, in advance. Other Countries in the Postal Union, 40/- per annum, in advance. A copy of the "G.J." Calendar and Directory is presented to continuous subscribers.*

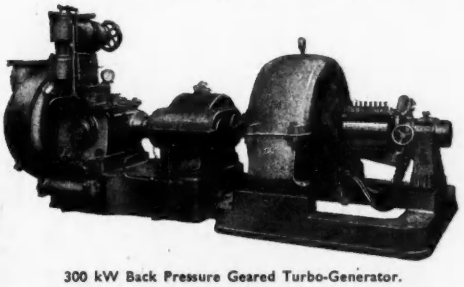
CLASSIFIED ADVERTISEMENTS.—*Situations Wanted, 6d. a line (minimum 3/-, about 36 words). Situations Vacant, Plant for Sale and Wanted Contracts, Public Notices, Educational, &c., 9d. a line (minimum 4/6). Financial Notices, 1/- per line. Box Number, 6d. extra. WALTER KING, LTD 11, Bolt Court, Fleet Street, London, E.C.4. Telephone: Central 2236-7-8. Telegrams: Gasking, Fleet, London.*

Advertisement Index, see p. 419.

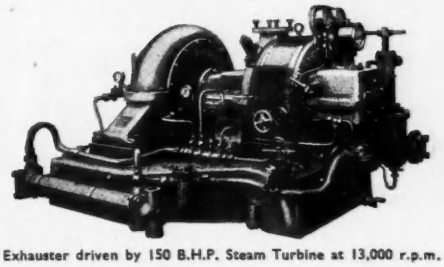
BROTHERHOOD
STEAM TURBINES FOR GASWORKS

Our Turbines, made for all powers up to 15,000 B.H.P. and for all conditions of service, are installed for driving Exhausters, Boosters, and Generators in many Gas Works, including:—

The Gas Light & Coke Co., South Suburban Gas Co., Wandsworth & District Gas Co., and in Works of Corporations and Companies at—Birmingham, Bristol, Coventry, Cardiff, Exeter, Liverpool, Manchester, Newcastle-on-Tyne, Preston, Portsmouth, Sheffield, Smethwick, Toronto, etc.



300 kW Back Pressure Geared Turbo-Generator.



Exhauster driven by 150 B.H.P. Steam Turbine at 13,000 r.p.m.

Brotherhood plant for Gas Works also includes Reciprocating Boosters, Water Coolin Towers, Air and Gas Compressors for all pressures and capacities.

PETER BROTHERHOOD LTD.

PETERBOROUGH :: Branch Offices in LONDON, LEEDS, MANCHESTER and GLASGOW

B

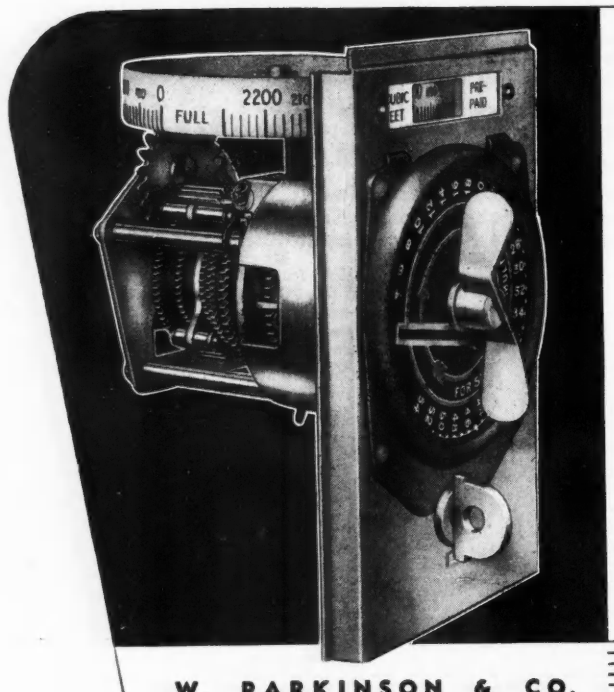
for

mechanically-lubricated

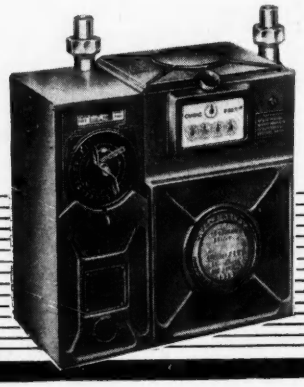
meters

THOMAS GLOVER & Co. LTD.

EDMONTON, LONDON, N.18 AND BRANCHES



Two coin optional meters



W. PARKINSON & CO.

(Incorporated in Parkinson & Cowan (Gas Meters) Ltd.)

Iron Lane, Stechford, Birmingham 9 — Cottage Lane Works, City Road, London, E.C.1 — Raphael Street Works, Cromac Street, Belfast

P3